
United States
Circuit Court of Appeals
For the Ninth Circuit

Transcript of Record 2

GEORGE J. HENRY, Jr.,
Complainant.

vs.

CITY OF LOS ANGELES,
Defendant.

VOLUME 6
(Pages 2001 to 2400 Inclusive)

Upon Appeal from the United States District Court for
the Southern District of California,
Southern Division

Company, had been submitted to either their engineers or their patent attorney, or some person whom the officers of the Pelton Company considered competent to judge, and that this party had reported that the governor made by the Pelton Company did not infringe claims of my patent.

XQ. 337. Was it your understanding or belief at the time you made this threat, sometime between 1906 and 1910,—probably 1908—that the Pelton Water Wheel Company was using a by-pass controlled by a by-pass valve operated inversely to the water-wheel gate?

A. I understood that that was one of the features of the governor which that company had developed.

XQ. 338. Please state how extensively to your knowledge a by-pass controlled by a valve operated inversely to the water-wheel gate, as described in your claims 6 and 7, has been used by various manufacturers since the grant of the patent in suit?

A. I cannot say, except that I know that only a small percentage of the governors in use in the eastern states is supplied with the by-pass arrangement. Just what the conditions are on the Pacific Coast, I do not know; but I have been given to understand that the use of the auxiliary by-pass is frequent. Of course, the conditions of power development make a difference in this respect. Where water wheels are set in open penstocks, as is almost universally the case in water-power developments up to 30 or 35 feet head, the by-pass can serve no useful purpose, and it has its application only where the turbines are completely inclosed and are supplied with water through a pipe or penstock of appreciable length.

So many of the water-power developments in the East are low head developments that there would naturally be but comparatively few by-pass valves used, even if there were no limitation on the manufacturers to place them.

XQ. 339. After your first knowledge of the use of the by-pass by the Allis-Chalmers Company in 1904, how extensively did the Allis-Chalmers Company use that device after that date?

A. That I do not know.

XQ. 340. When did you next hear, after 1904, of the use of a by-pass valve operated inversely to the water-gate valve, as described in claims 6 and 7 of the patent in suit?

A. I think it was 1906 or 1907.

XQ. 341. Please state the circumstances of that use and your knowledge thereof.

A. A description of some plant in the West, I believe in California, the machinery for which was supplied by the Abner Doble Company, was described in one of the technical journals, and among other features was a by-pass valve operated inversely to the main or water-gate valve. I do not now recall where the plant was located. I simply remember the manufacturer.

XQ. 342. Did you take up with the Abner Doble Company the question of the purchase of your patent or did you protest against the use of this device in the plant which you have mentioned in your last answer?

A. I think that I never communicated with the Doble Company on this subject. It was located too far away, and I was at that time attempting to get some arrange-

ment with other companies, believing that if the patent were taken over by one of the other companies that the very fact that additional infringers had begun the manufacture of this apparatus would be proof to the companies with whom I was attempting to reach a business conclusion, that the device offered had not only one but several elements of value. It was my understanding that unless I could compel some infringer who was more accessible to me to take some action which would be satisfactory, that under the circumstances it would be hopeless to compel one as far removed from my location as the Abner Doble Company, particularly if there were infringers in the East, of which the Doble Company would probably have information. I therefore set that knowledge aside in the expectation that it could be used at some future time.

XQ. 343. You have spoken of infringers in the East. Please mention the companies which at that time you considered to be infringers of your patent in the East.

A. I considered the Allis-Chalmers Company an infringer; I considered the Pelton Water Wheel Company an infringer, which, though not an eastern concern, did a great deal of eastern business; I was informed that the I. P. Morris Company was preparing to market a governor which would have been an infringement of my patent, and I notified it also of this fact. It was subsequent to the disclosure of the infringement of the Abner Doble Company that the complete infringement of the Lombard governor was disclosed to me. I do not now remember any others that were infringers, or whom I

knew to be infringers, of the complete structure as disclosed in the patent, at or near the time that this article describing the plant supplied by the Abner Doble Company came before me.

XQ. 344. Do you recall what plant it was that was supplied by the Abner Doble Company that you have heretofore mentioned?

A. I do not. I believe that the description appeared in one of the bulletins of The American Society of Mechanical Engineers, and that a reference to the transactions of that Society would disclose the date that it came before me. But what the structure was and, further, where the plant was located, I do not now remember.

XQ. 345. As an engineer were you interested in the project of the Los Angeles Aqueduct, and did you follow the development of that to any extent?

A. No. It was a class of engineering construction that was somewhat removed from the lines which I follow, and, while I knew that the Los Angeles Aqueduct was being constructed, because of frequent references to it in the technical journals, that was the extent of my knowledge, as I never read the articles describing it and never knew anything of its character or magnitude until some time ago when one of the pipes forming a portion of a siphon, collapsed; and as this question of collapse of large water pipes is one that I had given a considerable amount of study to, and had been investigating for some years, this interested me. But not until then did I learn anything concerning the Los Angeles Aqueduct.

XQ. 346. About when was it that you first became

then interested in any feature of the Los Angeles Aqueduct?

A. My memory is that it was about a year ago. A reference to the files of the Engineering News, which journal conveyed to me the information of the failure of this pipe by collapse, would show exactly the date.

XQ. 347. Were you interested in any way in ascertaining the method of governing of the water wheels of any of the plants along the line of the Los Angeles Aqueduct at any time?

A. No. I never knew until my arrival in Los Angeles on the 4th day of the present month that there were any power plants on the Los Angeles Aqueduct, it having been my impression up to that time that the supply of water to the municipality for ordinary domestic uses was the entire function fulfilled by this construction.

XQ. 348. So that you never heard of either of the hydraulic plants which are involved in this controversy, before coming to Los Angeles?

A. No.

XQ. 349. When did you first become acquainted with Mr. George J. Henry, Jr., the complainant in this suit?

A. Personally?

XQ. 350. When did you first open negotiations or get into communication with Mr. Henry?

A. I do not remember. I think it was in the year 1912.

XQ. 351. Might it have been as late as 1913?

A. It might have.

XQ. 352. Could you swear positively that it might not have been 1911?

A. I could not; but my impression is very definite that it was subsequent to 1911.

XQ. 353. Please state the circumstances as fully as you can, together with the time and place of your first communication with Mr. Henry concerning the patent in suit.

Mr. Blakeslee: We object to this question as needlessly encumbering the record, incompetent, irrelevant and immaterial. Testimony has been introduced when the patent in suit was purchased by Mr. Henry, the complainant, from the witness, and it cannot be material how long the witness has known the complainant and it cannot affect the issues of the case in any manner.

A. As for the time, I can only fix it as being subsequent to the dissolution of the firm of Duncan & Lyndon, and my removal of my offices to the Knickerbocker Trust Building at 60 Broadway, which took place in 1910. The communication was in the form of a letter from Mr. Henry asking me if I was still owner of the patent in suit, and, if so, at what price I would sell it. I replied to this naming a certain price and conditions, and this, I believe, was the first time I ever had any communication from Mr. Henry on the subject.

XQ. 354. By Mr. Westall: Will you please state the price and conditions which you offered Mr. Henry the patent for?

Mr. Blakeslee: Objected to as not the proper method of proof, not the best evidence, the negotiation between the parties having been reduced to a written instrument

which is in evidence, being an assignment from the witness to complainant, and this documentary evidence being the best evidence as to the culmination of this transaction, and that this is irrelevant, immaterial and incompetent.

A. I named a price of \$7500 cash payment and a royalty, the amount of which royalty I now do not remember. But the payment of royalties based on the quantity of business done in the sale of structures made in accordance with the patent in suit was to continue throughout the life of the patent.

XQ. 355. By Mr. Westall: What response or reply did you get to that offer?

Mr. Blakeslee: The same objection.

A. I do not remember either the date or the form of any response to that letter. In substance, Mr. Henry declined to purchase the patent on those terms.

XQ. 356. By Mr. Westall: Did Mr. Henry at that time make you a counter-offer?

Mr. Blakeslee: Objected to on the same grounds.

A. I do not remember that he made a counter-offer.

XQ. 357. By Mr. Westall: What further negotiations did you thereafter have?

Mr. Blakeslee: The same objection.

A. Some time after this first correspondence, Mr. Henry wrote me and called my attention to the fact that the patent had not many years to run and that in spite of my efforts to place it I had not been successful, and he suggested that if I were willing to take a very reasonable price for it that he might be able to purchase it. I at that time had no other prospect for its use, and had

come to the conclusion that without capital to enforce such rights as had been granted me that I could not make this patent remunerative to me, and I therefore named a merely nominal figure, which Mr. Henry accepted.

XQ. 358. By Mr. Westall: Will you please state what that figure was?

Mr. Blakeslee Objected to on the same grounds, as not the best evidence, the assignment in evidence last referred to being the best evidence.

A. \$2500.

XQ. 359. By Mr. Westall: What were the terms of payment of that sum of \$2500?

Mr. Blakeslee: The same objection.

A. It was substantially a cash payment. It, however, was made in two payments, owing to a misunderstanding between Mr. Henry and myself, and I think those two payments were separated two or possibly three weeks apart until correspondence passed between us. But to all intents and purposes it was a cash payment.

XQ. 360. By Mr. Westall: And was that sum of \$2500 paid substantially as agreed by Mr. Henry?

A. Yes, it was.

XQ. 361. And have you received at the present time all of the consideration for the sale of the patent?

A. Absolutely every cent.

XQ. 362. Was there any arrangement made at that time whereby you were to produce evidence of the date of your invention before the passing of any consideration?

A. The only arrangement was that I should furnish

Mr. Henry with affidavits of persons to whom I had disclosed this invention at the time it was made; but there was no arrangement regarding any testimony by myself, if I understand your question, on the subject.

XQ. 363. And when did you furnish those affidavits and those sketches or drawings? Was it before or after the contract of purchase was entered into between you?

Mr. Blakeslee: Objected to as not the best evidence. The affidavits speak for themselves and the assignment speaks for itself, and the papers could manifestly not have been furnished prior to the date of the annexed affidavit.

Mr. Westall: It might be proper to call counsel's attention, as he has on one or two occasions himself done, to the rule which prohibits argumentative objections.

Mr. Blakeslee: Counsel for defendant apparently does not understand the difference between an objection with ground given and an argument based upon an objection. I am merely stating the grounds of the objection as conforms with the rule.

A. If I remember correctly, the contract of purchase was made prior to the securing of these affidavits. It was understood between Mr. Henry and myself, whether in the agreement or whether in a letter which was one of the communications between us, I can not say, that I would furnish him affidavits of date of invention. But I believe these were supplied subsequent to the agreement. My transaction was not directly with Mr. Henry after the first few communications, but with Messrs. Prindle & Wright, his attorneys, in New York, and they of course, acted for Mr. Henry's best interests and

made an effort to secure even better terms than Mr. Henry and I had practically agreed on, and it was through them that the \$2500 was paid.

XQ. 364. By Mr. Westall: What arrangements did you make at that time for appearing as a witness in this case?

A. None whatever.

XQ. 365. Were you informed in any way that you would be required to testify?

A. Not until I received a telegram from Mr. Henry about two weeks ago asking me if I could appear and if I would. I want to say though, that prior to that time, after this transaction, I wrote Mr. Henry at the time that I got up some old correspondence on this subject for him, that if he at any time would require any testimony, in view of the fact that I was in Austin, Texas, so frequently, I, of course, would be glad to give testimony. But as I remember, he never replied to this suggestion, and I never had any intimation from him that he would desire to have me testify until the receipt of this telegram.

XQ. 366. So that any arrangement that you may have now for compensation for your services and time in coming out here to testify is entirely disconnected with the original agreement made for the purchase of the patent?

A. Entirely; it has no relation to it, and under the agreement I was and am under no obligation to testify in this case.

XQ. 367. Now, you have stated that at no time since the granting of the patent have you felt that you

could spare \$3,000 to enter into litigation against alleged infringers of the patent. Have you at any time prior to the sale of the patent to Mr. Henry been able to spare \$2500, with a little sacrifice, in order that the suit for infringement might be instituted?

Mr. Blakeslee: Objected to as needlessly encumbering the record and prying into the private affairs of the witness. We will insist that the witness has testified that at no time while he owned the patent in suit was he sufficiently financially equipped to start an infringement suit and prosecute it to a finish. As before stated, there is no standard of measurement of the cost of a suit, and this evidence is, as far as the question can be put in fairness to the witness, without inquisitively seeking to pry into his personal affairs.

A. I do not believe that at any time I would have been able to furnish \$2500 in cash for this purpose, and if I had been able I would have regarded it as so totally inadequate that I would not have attempted to bring a suit against any great corporation, with its resources and staff of patent attorneys, with such a small fund to do it.

XQ. 368. By Mr. Westall: Have you at any time during your ownership of the patent been able to spare even with a little sacrifice the sum of \$2000 in order to institute and prosecute a suit for infringement?

Mr. Blakeslee: The same objection. We notify counsel for defendant that if he persists in this useless, frivolous and time and space wasting inquiry, we shall move to have the cost of taking and returning the cross-examination of this witness taxed to the defendant.

A. While willing to testify in any manner and in answer to any question that bears on this subject, it appears to me that in view of my statement that I did not have ever an amount of money which I regarded as in any way adequate to bring suit to sustain the validity of my patent, that the possession of any lesser amount would hardly bear on the matter in any manner. And while I have nothing to conceal in regard to my own private affairs, I judge that when they have disappeared from possibility of relationship to this suit they become specifically my private affairs, and, for this reason I prefer not to make a specific reply to the last question, unless instructed by counsel to do so.

Mr. Westall: I would state for the witness's information that the question is not asked for the purpose of prying into his private affairs, but simply to make most specific on a very vital issue in this case the general financial conditions which have been made on direct examination.

Mr. Blakeslee: It does not make any difference whether counsel intends to pry into the witness's private affairs or not. The fact remains that he is prying into them. That the witness having testified that he at no time had money which satisfied him would be sufficient to carry through this suit, that is, money to apply to this purpose, the inquiry is satisfied so far as it can properly go. For, as we have stated before, there is no standard by which counsel can hope to establish the fact whether \$1,000 or \$20,000 would have been sufficient for the purpose. The question is, therefore, wholly irrelevant, and the inquiry is futile for any purpose of proving any issue in this case. It might properly have been

that the witness considered that \$20,000 would not have been sufficient for the purpose mentioned, and the inquiry can go no farther than what the witness considered would be a proper amount. And as to that, he has fully answered.

A. In further amplification of my answer, I would say that I have known considerable about patent suits, their extent and their cost; and with the knowledge which I possessed, I would not have undertaken to bring this patent into court with less than \$6,000 in cash on hand which I could devote absolutely to this purpose. And, as I have testified, I have never seen the time when in my judgment I could spare even \$2500 for this purpose.

XQ. 369. By Mr. Westall: Do you mean to say by your last answer that you might have spared \$2,000 for this purpose, if you were satisfied by reason of any peculiar circumstances that the \$2,000 would have been sufficient to prosecute the suit?

Mr. Blakeslee: The same objection, and the further objection that the question has already been fully answered. And we repeat our objection to encumbering the record with this foolish line of inquiry.

A. That conclusion cannot be deduced from what I have stated, nor have I stated that I at any time had even as much as \$2,000 that I could have devoted to this suit, nor have I indicated that at any time have I had as much as \$1,000 or even \$500 that I could have devoted to this purpose. Whether any one of these sums might have been obtained by me for the purpose, I would not have considered it advisable to embark in the litigation without more than any one of these amounts.

XQ. 370. By Mr. Westall: Is this because in your opinion your patent was of such doubtful validity, or was it because you feared that you could not prove infringement?

A. It was neither of these. It was the fact that such cases as I knew of were often prolonged over such lengths of time that no matter how clear the question of validity or infringement might be, it no wise followed that I would obtain a judgment within what might be considered a reasonable period of time, which further meant that in addition to the payment of all the disbursements and costs incurred I would be obliged in a considerable measure to neglect my practice, which, as I say, was my only source of income, in order to prosecute any litigation. In other words, whether my judgment was correct or not, it was to the effect that without enough money to prosecute the case and to decline to take certain engineering commissions, and in the meantime, to meet all my necessary expenditures, that it would be impracticable to fully and thoroughly prosecute any suit for infringement, and it was not my intention to enter into anything that I could not see brought to a finish. These statements, I think, cover fully the question of my inability to compel a recognition of the rights which I acquired under this patent and to force infringers to make proper and compensating business arrangements for the use of the device covered in the patent.

XQ. 371. It was then not solely not being able to raise the necessary money, but other considerations, such as your professional duties, and also the question of policy as to whether it would be wise for you to go

into litigation with any of those big concerns who might be the means of your receiving commissions that restrained you from beginning suit against any of the alleged infringers of your patent. Is that correct?

A. Only partially. The whole question was one of sufficient funds. The necessities which you mention of continuance of professional work were those which arose from the necessity of my continuing to procure enough money to subsist on and meet the necessary expenditures that every man has. If I had had a sufficient sum of money to prosecute the case properly and to give the amount of time to it necessary, I should certainly have done so; and in the absence of either one of these factors, I realized that the expenditure of any sum which would be inadequate would likewise be futile. But, in the last analysis, it was always a question of a sufficient amount of money only.

XQ. 372. If you had been furnished with the sum of \$6,000 and your other circumstances had remained the same, would you have embarked upon litigation against any of these various infringers? Or would you have found some other and more profitable use for the money?

A. I feel sure that I would have brought suit against the infringers, and I would have felt equally sure that I would not have found a more profitable use for the money, because I have always felt in my own mind that the patent was valid and that I was a pioneer in the art, and this impression was so strong that I have never felt that the final issue in court could be doubtful if it could be brought to an issue. But, if you will recall, I have testified that I have seen and had at that time considerable experience with patent suits and had a knowledge

of the conditions under which they had to be brought and maintained. You will understand fully how clear it was in my mind that an adequate sum and ample time were both necessary to sustain even the patent in which I had as much confidence as I have expressed myself as having in this one.

XQ. 373. It is true, is it not, that prior to your invention, manually operated means for permitting water, the use of which was not desired at the wheel, to flow around the wheel, or to be by-passed without acting on the wheel, was known, and had been used?

A. I am not sure about this. I believe that to have been true, but what the form of mechanism, where it was located, or in what condition it operated, I do not know.

XQ. 374. At the time of your invention had you ever known of a by-pass being used to maintain a constant flow of water in a penstock, manually operated, or otherwise?

A. No. The invention was absolutely original with me.

XQ. 375. Did you explain fully to Mr. Meyer in the conversation at the restaurant in New York, in 1898, your provision for maintaining constant flow in the pipe-line by the use of a by-pass?

A. No, because it was never my intention to have a constant flow in the pipe-line, and neither my invention nor patent calls for such a condition.

XQ. 376. What did you explain to Mr. Meyer, if you recall, at that time, in relation to the purpose and function of the by-pass?

A. I explained to him that when the water-wheel gate

would be moved, say in a direction to close, if there were no compensating means and the gates of the water wheel were closed quickly, the energy in the mass of water in the pipe-line could not be instantly retarded to accord with the new position of the water wheel gates. For a few instants, therefore, the condition of a diminished opening, but the same quantity of water passing through this diminished opening at a higher velocity, would result. The velocity of the water wheel is dependent not only on the quantity of water entering, but also partly on its entrance velocity. Hence, for these first few instants there would be substantially the same quantity of water as had passed through the gates before their partial closure ^{at a higher velocity, so that instead of} ~~of the water-wheel gates is made by a rapid~~ diminishing the speed of the water wheel, which would have been the object of partially closing the water-wheel gates, the speed for these first few instants would actually increase and then begin to decrease, as the body of the water in the pipe-line gradually decreased in velocity, which decrease in velocity would come from the partial choking effect, due to the smaller opening of the water-wheel gates. With a by-pass arrangement a partial closure of the water-wheel gates is made by a rapid opening of the by-pass valve, so that the total area of the openings through the penstock is not greatly diminished, and not diminished in anything like the same ratio as that area would be diminished without the by-pass. This action, of course, allows, during the short period of governing, a considerable flow through the by-pass. The next step in the process of governing is to prevent the flow of the water from being any greater than necessary to supply the turbine and at the same time to cause

this prevention to be distributed over such a length of time that the velocity of the mass of water in the pipe is gradually retarded. This is effected by permitting the by-pass valve to return towards its closed position, thereby shutting off the passage of water or partially shutting it off, through the by-pass. But the rate of motion of the by-pass valve must be slow enough to allow a gradual retardation of the velocity of the column of water in the pipe, so that no excessive velocities of water through the water-wheel gates take place. The length of time required for the by-pass valve to return slowly to its normal position, which means, of course, the length of time required for the retardation of the velocity of the water in the pipe, is comparatively very great as related to the length of time to open or close the water-wheel gates if good regulation is to be given. That is, the water-wheel gates must very quickly respond to changes in load. The water column cannot quickly respond to changes in load. There must be a time element in the change of the velocity of the water in the pipe, and that time element is transferred from the water-wheel gates to the by-pass and by-pass valve. It was the combination of these physical phenomena and the methods of obtaining good governing in spite of the difficulty produced by the inertia of the water column, that I explained to Mr. Meyer and illustrated in the sketch which I made for him.

XQ. 377. Did you at that time explain to Mr. Meyer any of the provisions for adjusting the by-pass valve so that it might occupy, under normal conditions of speed and load, either a half-open position or a closed position, or any intermediate position?

A. I do not remember, but it is my impression that I did not discuss that specific feature with Mr. Meyer at that time. My reason for this belief is that the disclosure was made to him at lunch and we did not have a considerable time to give to this meal, and I had previously disclosed to him the speed-control device and the returning device, and it was on Mr. Meyer's suggestion that the rapid velocity of gate movement which I was attempting to produce would set up comparatively high pressures of, it might be, under certain conditions, partial vacuum in the pipe-line, that this idea at that time occurred to me; and I remember that it occurred to me instantly and I sketched it out, indicating that the by-pass valve would be in a partially open condition. I think that it was not until I discussed the matter later with Mr. Thorburn Reid—

XQ. 378. (Interrupting) At what time?

A. My memory would fix it as within from ten to fifteen days. I am sure from certain collateral circumstances that it was within sixty days' time after I first made the sketch for Mr. Meyer.

XQ. 379. After the restaurant talk in June, 1898?

A. Yes.

XQ. 380. By Mr. Blakeslee: June or July?

A. Yes; June or July. It is my present memory that in a discussion with Mr. Thorburn Reid he called attention to the fact that my system of governing would only be available in a plant where the water supply would be always in excess of the demand for water for power purposes. It was after thinking on this for a short time that it occurred to me that the by-pass valve could be set for its normal position in the half-open and half-

closed position during the period of the year when there would be an ample supply of water, and in periods of low water it could be adjusted so that its normal position would be closed, and it would then operate in a direction to open when the water-wheel gates were closed. This point I discussed with Mr. Reid after I had given it some thought, and, I believe from this answer something occurs to me which will enable me to fix the time. At the time I was discussing this with Mr. Reid, he showed me a design he had just made for the American Impulse Wheel Company, in which four impulse wheels were fastened on one shaft, and he had arranged the governing so that on full load the governing would take place on one nozzle only. When the load would drop below full load and between fifty and seventy-five per cent load, one nozzle would be closed and three nozzles operating, and the governing taking place on the second nozzle only; and so on, through the four wheels mounted on the one shaft. It is possible that Mr. Reid from this statement will be able to fix the time of my conversation with him about having the by-pass valve completely closed during periods of low water, or closed during the whole year in the case of governing plants where the demands for water for power would always be equal to the quantity of water available.

XQ. 381. By Mr. Westall: You considered this feature of this adjustment of the by-pass valve as an important feature of your invention, didn't you?

A. I am not sure as I regarded it as particularly important, in that the provision of the by-pass for the butterfly valve, which admitted of any kind of adjustment,

seemed to me at the time to be one of the most important features, and the question of adjustment of that valve to one position or the other did not appear to me important, as far as the invention might go, because it, to my mind, would be an obvious thing to adjust an adjustable valve to accord with the conditions which might be encountered wherever it would be installed.

XQ. 382. Now, in the conversation with Mr. Meyer in the Westchester restaurant in New York in June, 1898, do you recollect distinctly the kind of a bill-of-fare they had at that time? Was it a two-sheet bill-of-fare in a binder, or was it simply a card?

A. It was a card. It was of a pinkish color, and it was about 5 by 7 inches, I should say. It is not that I specifically remember this card, but that this form of menu card was standard at that restaurant, and for nearly a year we habitually went to lunch at this restaurant.

XQ. 383. Was it printed on both sides?

A. No; only on one side.

XQ. 384. And this sketch that you made and that you have attempted to reproduce from memory, "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketches of June and July, 1898," was made, as you recall, on the back of that bill-of-fare?

A. Yes; a sketch to which this is as similar as my memory and knowledge of my methods of making sketches has permitted me to produce.

XQ. 385. Now, have you any very positive and distinct recollection that you did make such sketch on the back of that bill-of-fare, or might you possibly be mistaken?

A. That the sketch which I made on the back of that bill-of-fare is similar to this sketch I not only do not remember, but I do not believe it to be exactly similar. That the sketch which I made on the back of that bill-of-fare fully disclosed every one of these elements I know and remember positively.

XQ. 386. And are you sure that you did make it on the back of the bill-of-fare, or might you have made it on some other paper?

A. I am sure that I made it on the back of the bill-of-fare, but I am under the impression that in the attempt to explain it that other and additional sketches were made, as was our custom at times, on the tablecloth or the napkins.

XQ. 387. You have also mentioned the margins of newspapers as possible places upon which sketches were made during the course of your conversation with Mr. Meyer in the New York restaurant in 1898.

A. It is highly improbable that any such sketches were made on the margins of newspapers. It is not impossible, but I should consider that it was very improbable, because it is not customary for business men in the down-town district to have newspapers with them at the lunch hour.

XQ. 388. Now, are you satisfied that this sketch, "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," if such sketch were made in substantial accord with the exhibit referred to on the back of the bill-of-fare in the restaurant in 1898 at the time of your conversation with Mr. Meyer, was sufficient for a technically trained man

of Mr. Meyer's attainments to fully understand the purpose and operation of the device?

A. I considered it so. I would consider that sketch ample to show fully, together with sufficient explanation that would accompany it and accompany the making of it, all of the elements which I disclosed to Mr. Meyer and which I then had in mind, with the understanding that the sketch as first made did not contain the by-pass valve nor by-pass, that being added after the conversation with Mr. Meyer and after an explanation to him of the other portions as indicated in the sketch.

XQ. 389. You have no recollection, have you, as to whether or not those devices were actually added at that time to the sketch you had previously made on the back of that bill-of-fare, or do you simply have the impression that they were very likely to have been made?

A. I know that I made a sketch showing the by-pass and the by-pass valve. It is possible that instead of adding it to the sketch then made that it was sketched on another card ^{or} on the tablecloth, simply showing that portion as separated from the rest. (The witness points to the by-pass and by-pass valve on the sketch.)

XQ. 390. If the sketch had been as complete as you have made it here in "Complainant's Exhibit Reproduction Sketch of His Disclosure Sketch of June and July, 1898," would it have been necessary to make other sketches on perhaps the margin of newspapers or on the tablecloth or on napkins or perhaps on another card, as you have suggested in your last answer?

Mr. Blakeslee: Objected to as incomplete, there being no designation in the inquiry as to the purpose of such alleged necessity.

A. It might have been.

XQ. 391. By Mr. Westall: And do you think that with this sketch exactly as it now appears on "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," if it had been placed on the back of the bill-of-fare in the Westchester restaurant in June, 1898, the time of your conversation with Mr. Meyer, that, in order to make your meaning clear to him it would have been necessary to make other sketches in addition to the one referred to?

Mr. Blakeslee: The same objection.

A. Not necessarily. In order to make my meaning quickly clear to him, it might have been necessary. It is usually a more rapid process to make a simple sketch than to enter into an explanation of a mechanical or electrical device. There are portions there (i. e. in the sketch) which are missing. For instance, the spring for returning the rod and disc of the returning device are not shown, and the sketch there shows a very short rod with no room to place the returning springs on it. These, in my mind, were understood as to be placed there just as is common in so many mechanical devices. It might be that Mr. Meyer, these being all surmises, inquired as to how that rod would be returned, and I might have made a sketch showing the returning springs. I do not say that this actually happened. I merely point it out to illustrate how additional sketches might have been made, in order that within the short time that we had together on this particular day I could have conveyed to his mind clearly any point that might not have been clear from the sketch.

XQ. 392. By Mr. Westall: At the time you made

that sketch you did not mark it with the names that appear on "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," did you?

A. I did not.

XQ. 393. So that it had no written words or printed descriptive words on it at that time that you remember.

A. No; it did not. I not only remember that it did not, but I would know that in accordance with my general habit in making rough explanatory sketches, it would not have carried any wording on it at all.

XQ. 394. It is true, is it not, that you had not figured out all the details by which your principle was to be incorporated into an actual working device at the time of your conversation with Mr. Meyer in the Westchester restaurant in New York in June, '98?

Mr. Blakeslee: Objected to as indefinite and calling for a mere conclusion as to construction and not for a statement of facts as to what details were inquired for.

A. I don't remember whether I had any of the details clearly worked out in a manner suitable for incorporating them into even an experimental machine. It is probable that the details of the controlling mechanism had been worked out, but this I do not know to have been true. I do know that the details for operating the by-pass valve were not worked out, because the idea only came to me at that time and I had in mind only an inverse working by-pass valve; and the method by which it could be made to move inversely to the water-wheel gate and return slowly to its normal position, I had not thought out, as, in the first place, there was not sufficient time at this interview, and, in the next place, it did not

occur to me as important, because there are so many mechanical movements and contrivances available for accomplishing just such purposes. This latter statement is evidenced by the later sketches and blueprints showing the evolution through which that machine passed before it ever reached the point of actual construction.

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XQ. 395. Did you at the time of your first disclosure to Mr. Meyer in the restaurant in 1898 explain to him the kind of valve you would use for either the water gate or the by-pass?

A. I did not explain to him the kind of valve that would be used for the water gate, as that was beyond the scope of my invention. The invention related to the moving of water gates in turbines and water wheels that would be supplied by the makers of these devices and, therefore, the governor which I invented would be called on to move many different types of water gates, depending on the make of water wheel to which the governor might be applied. I did sketch out and show Mr. Meyer the butterfly valve in the by-pass.

XQ. 396. Is this Mr. Henry C. Meyer, Jr., to whom you made these disclosures in the restaurant in 1898 still living?

A. He is still living and in general consulting engineering practice in New York.

XQ. 397. How long has it been since you were last in communication with him?

A. I believe I saw Mr. Meyer in July, 1914, last.

XQ. 398. Have you had any correspondence or communication with him concerning any of your alleged

disclosures to him in June or July, 1898, in the restaurant in New York, as described by you?

A. I do not recall any written communication which passed between us. I have spoken to him in person about this disclosure.

XQ. 399. And did you at that time reproduce any sketches or discuss with him in detail the circumstances of any such conversation or disclosure to him in June or July of 1898 such as you have described?

A. I do not recall that I made any sketches. The character of my conversation with him on this subject was to inquire if he remembered the circumstance of my having made the disclosure of certain parts of my invention, and to have invented certain other parts in his presence at the time of making those disclosures.

XQ. 400. You say you do not recall having made any sketches. Might you have made sketches which you cannot now recall?

Mr. Blakeslee: Objected to as frivolous and impossible of answer within the rules of evidence. A man can only testify by his recollection and cannot testify to the possibility of anything existing which he cannot recollect.

Mr. Westall: The question simply goes to the certainty of the witness's memory on the point.

Mr. Blakeslee: Then it is an attempt to attack his memory, which you cannot do by the question itself, which in its very nature probes beyond his recollection.

A. Being capable of making sketches, it is quite possible that I may have made a large number that I do not now remember. As to the surety of never having done

anything which I do not remember anything about, I cannot, of course, testify definitely.

XQ. 401. By Mr. Westall: It may possibly be that my question is misunderstood. I am speaking now of the time which you have fixed as sometime in 1914, at the time of your conversation with Mr. Meyer, in which you recalled to his mind or knowledge some conversation had between yourself and Mr. Meyer concerning the disclosures which you allege to have been made in June or July, 1898, and my question is whether or not at the time of that conversation in 1914 you made or exhibited to Mr. Meyer any sketches of the device which you have testified you disclosed to him in 1898?

Mr. Blakeslee: We object to the question as repetitious and already answered, and uselessly encumbering the record with repetitious matter; and we further object to the taking up of the time of ourselves and of this witness with this mere repetitious and useless question.

A. I do not remember to have made any sketch whatever for Mr. Meyer at this time, and in this connection; and it is my belief that I did not make any such sketches. The fact that it is an engineering habit to partially converse in quickly made rough sketches rather than by the extensive use of words, precludes the possibility of an engineer stating definitely that he never did make any sketches at any time. I do not believe that I made any such sketches, and under the conditions I can see no reason which would have called for them.

XQ. 402. By Mr. Westall: Have you made any effort to ascertain from Mr. Meyer whether or not he pre-

served any of the sketches which you say you ^{may} have made in the restaurant in June, 1898, at the time of your alleged first disclosure to him?

A. No. A suggestion of that kind would have been so manifest an absurdity under the conditions, that I never even suggested it to Mr. Meyer.

XQ. 403. When you used the language in referring to your conceptions and disclosures to Mr. Meyer in the restaurant in June, 1898, "which was on that date and at that specific time that the invention disclosed in the patent here in suit was completed, so far as my conception of it is concerned," you do not mean to imply that you had in mind the exact number of electro-magnets, contacts, clutch gearings, butterfly valves and their specific connecting devices by which they are made to operate upon and with each other, they together constituting the means described in the patent in suit, or do you mean that you had clearly the idea of the result to be accomplished by the broad general features, such as by-pass and the dynamo wound as you have described, and that with these salient features in mind you believed that these specific means or instrumentalities by which these features were to be utilized would be a matter of small consequence?

Mr. Blakeslee: Objected to as indefinite, and, in so far as any purported quoted matter, may not be in accordance with the record; and furthermore, as being repetitious and calling for an answer in substance already given, the witness having testified that at the time of that conference he had not worked out all the specific details of the organization embodying the invention.

A. The state of the invention in my mind was somewhere in between the two sets of conditions which you have mentioned in your question. I had a clear and definite idea concerning the arrangement of most of the parts. I had in mind all of the elements which have been disclosed in the invention. I had not in mind the actual mechanical ^{methods} ~~means~~ by which the various parts would be made to cooperate with each other. As you have stated in your question, I did not consider this factor as important. There are so many mechanical and electro-magnetic means for producing the same identical result, that the actual design of the machine with the principles on which it is to operate to guide the designer, that the final form the machine will take is largely personal to the designer. That is to say, if the patent in suit was distributed to four able machine designers, the four machines which would be independently produced would be very different in their details, and the designs would not probably even resemble each other. At the same time, the functions which each one of these machines would perform and the manner of its performance, would be identical. So that the question of actual mechanical design of the connecting portions of the mechanism between the different fundamentally-operating parts, I had given no consideration to, and did not for some time after this disclosure to Mr. Meyer.

XQ. 404. By Mr. Westall: On your direct examination you have identified "Complainant's Exhibit A," in this case, as a copy of letters patent No. 695220, you say covers the "essential features" of a water-wheel governor which you had invented and which in-

vention you say was completed prior to July, 1898. I will ask you to explain more fully what you mean by the language "essential features."

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony already given, the witness having gone extensively into the various factors and attributes and functions and elements of the invention.

A. The essential factors were a sensitive speed responsive device causing the operation of a mechanism which would operate the gates of the water wheel to open or close them in accordance with speed changes to which the speed-sensitive device would respond; means for ~~returning~~ the displaced portions of the speed-sensitive device to their normal position before the speed of the water wheel had reached its normal value; a by-pass connected to the water pipe at or near the turbine casing; a balanced, substantially frictionless valve in this by-pass, adapted to be moved by mechanism connected with the mechanism which would operate the water-wheel gate, the direction of motion being opposite to that of the main water-wheel gate, and this by-pass valve being returned from its displaced position after governing, to its normal position, the rate of motion in this latter case to be comparatively slow.

XQ. 405. By Mr. Westall: So that prior to July, 1898, you had invented a governor combining not only the essential features which you have described in the patent in suit, but also other features which you thereafter found to be unessential features and which you, for this reason, left out. Is that correct?

Mr. Blakeslee: Objected to as argumentative and placing an arbitrary construction upon the invention

which, as coming from counsel, is not the best evidence, nor evidence at all, and an attempt merely to put such arbitrary construction in words into the mouth of the witness, and as indefinite, nebulous and immaterial.

A. I do not recall that I had invented any features in connection with this governor which I afterwards considered unessential and omitted.

XQ. 406. By Mr. Westall: Then, if that is true, your statement heretofore made that you only incorporated in the disclosure of the patent in suit the "essential features" of the governor invented by you prior to July, 1898, is not strictly accurate. Is that correct?

Mr. Blakeslee: The same objection.

A. No. That statement is strictly accurate, and, after due and further consideration of the conditions I see no occasion to modify it in any particular.

XQ. 407. By Mr. Westall: Then it is true, is it not, that there were incorporated in your alleged invention prior to July, 1898, certain features which you have described as "essential features" and which were afterwards incorporated in your patent in suit, and other features which were not essential features and which, for that reason, were left out. Is that correct?

Mr. Blakeslee: The same objection.

A. The first portion of your question is a correct statement of conditions. But as to the latter portion of your question, I cannot recall that I omitted from the patent application any part or feature which I had in mind when I made the invention and which I disclosed to Mr. Meyer as before recited.

XQ. 408. By Mr. Westall: Now, you have men-

tioned Mr. E. A. Merrill, Mr. Thorburn Reid, Mr. Richard R. Bryan, Mr. Edward Lyndon, Mr. Campbell, Mr. Martin, Mr. David S. Hays, Mr. Shipley, Mr. Bailey, the patent attorney, and Knight Brothers, as recipients of certain disclosures relating to the device of the patent in suit. Will you please give the dates, or as nearly as possible approximately the dates, as you can recall, when the disclosure was made to the persons mentioned?

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony, which, as the witness has and as the record shows, the witness has fixed with great care as to the times of the disclosures to the several parties designated in the record, and as a mere attempt to string out and encumber the record and harass the witness and impose upon him unnecessary labor.

A. The disclosure to E. A. Merrill was sometime prior to December, 1898, and, I believe, prior to November of that year. The disclosure to Thorburn Reid I believe to have been within two weeks after the disclosure to Henry C. Meyer, Jr., although it might have been probably the latter part of July or first part of August, 1898, before the disclosure was made to him. To Richard R. Bryan the disclosure was made at the same time; that is, within one or two days,—within one or two days' difference of time,—that it was made to Mr. Thorburn Reid. Mr. Bryan was Mr. Reid's assistant. The disclosure to Edward Lyndon was during my visit to Athens, Georgia, in 1898, and sometime during the month of July. The disclosure to Campbell was at or near the time of the disclosure to Messrs. Thorburn Reid and Richard R. Bryan. Mr. Campbell was con-

nected with the American Impulse Wheel Company, for which company Mr. Reid was acting as consulting engineer. The disclosure to Mr. Martin was sometime prior to November 1, and, I believe, prior to October 1, 1898. I am not sure about the disclosure to Hays, except that it was near the end of 1898 or the early part of 1899. The disclosure to Shipley was sometime in the early part of '99, I believe February, although it might have been earlier or later. The disclosure to Bailey was not made by me, but by the York Manufacturing Company through sketches and descriptions furnished the latter company by myself. I, therefore, do not know the date of this disclosure except that it was made during 1899, and I had every reason to believe it to have been the late spring or early summer of that year. The disclosure to Knight Brothers was made during the year 1900, and I believe it to have been in March or April of that year. The records of Knight Brothers would probably show this definitely.

XQ. 409. By Mr. Westall: Have I named in the last question all of the persons who you remember as being the recipients of disclosures concerning the patent in suit prior to your application therefor?

A. No; there are others, a few of whom I remember and some whom I do not now recall, other than those whom you have mentioned, to whom I made the disclosure of this invention.

XQ. 410. Will you please give the names of any others that you now recall?

A. I disclosed this invention to Mr. William E. Gibbs, who is a consulting engineer in New York at the

present time, and who was formerly professor of physics in the Carnegie Technical Schools at Pittsburg. Also to a Mr. Van Dyke, whose initials I do not remember, but who was connected with the American Impulse Wheel Company at the time when this matter was brought to the attention of that company. I believe also to Mr. E. M. Sutliff, at present chief engineer of the American Trading Company. About this time I had employed Mr. Sutliff, in my capacity as chief engineer of the American Trading Company, to go to Yokohama, Japan, and take up the engineering work of the Trading Company at that place, and I was with him three or four weeks continuously prior to his departure. This comprises all the additional names I can now recall.

XQ. 411. Can you state approximately the dates on which you disclosed your invention to the persons you have last named, that is to say, Mr. William E. Gibbs, Mr. Van Dyke and Mr. Sutliff?

A. The disclosure to Mr. Gibbs was made during the latter part of 1898 or the early part of 1899. I am not very clear as to the exact time except that I know it to have been considerably prior to the 1st of January, 1900. The disclosure to Mr. Van Dyke was made at approximately the same time as to Messrs. Thorburn Reid, Richard R. Bryan and Campbell, Mr. Van Dyke being associated with these gentlemen in the American Impulse Wheel Company. The disclosure to E. M. Sutliff was made either the latter part of 1898 or early part of 1899. I am inclined to believe that the disclosure to Mr. Sutliff was made sometime during the year 1898, for the reason that I left the American Trading Company in the beginning of 1900. I had made arrange-

ments to send Mr. Sutliff to Japan. He had gone there, had taken up his duties with the American Trading Company, and returned to America prior to my leaving the American Trading Company. Therefore, his return was sometime not later than the early part of 1900, and when I left the American Trading Company he was employed to take my place. In view of the fact that Mr. Sutliff was with me for some three or four weeks prior to his departure for Japan, that it took approximately twenty days to go there from New York, the same length of time to return, and that Mr. Sutliff was many months in Japan, it is obvious that collating these facts with the approximate date of his return, namely, prior to January 1, 1900, that he must have gone to Japan either in the year 1898 or very early in 1899. My present memory is that the disclosure made to him was prior to November, 1898.

XQ. 412. Are all of the persons whose names you remember as having been the recipients of disclosures or conversations relating to your alleged invention still living?

A. All with the exception of Mr. Marcellus Bailey and Mr. Richard R. Bryan.

XQ. 413. Which if any of the persons whose names you have given as recipients of disclosures concerning the alleged invention of the patent in suit, have you communicated with since the opening of negotiations with Mr. Henry, the complainant in this case, for the purchase of the patent in suit?

A. Henry C. Meyer, Jr., E. A. Merrill, Thorburn Reid, Edward Lyndon, F. A. Wunder, Thomas Shipley and Aubrey H. Martin.

XQ. 414. Did you discuss the matter fully with each of the persons you have mentioned in your last answer, of the disclosures and conversations had with them concerning the invention of the patent in suit?

Mr. Blakeslee: Objected to as not the proper method of proof and attempting to place an arbitrary construction on whatever the witness may say in response to the question, the proper method of proof being to ask the witness what he did in connection with such disclosure, if counsel is not already satisfied with the record in those respects as so far taken. And if he is not so satisfied, then we object to the question as calling for mere repetition of the testimony already given.

A. I did not discuss fully this subject with all of these gentlemen whose names have here been mentioned. I saw them at opportune times, and of each one I inquired if he had any memory of the fact that I had at one time disclosed to him a water-wheel governor, and, if so what his recollection was of such disclosure. And these different parties in many instances refreshed my memory concerning the different disclosures and how far they had understood the disclosure at the time. So that their memory of the matter seemed to be quite clear, and we of course discussed some of the previous conversations that we had. But I do not remember that in any case did we fully discuss the subject further than as I have mentioned here. In the case of one or two of the parties I did not myself see them personally at all, but communicated with them through Dr. A. S. Chessin who himself asked such of these parties as I did not see if they had any memory of the disclosure.

XQ. 415. By Mr. Westall: What efforts have you made, if any, to ascertain what became of the records of Mr. Bailey, the patent attorney, which might show the date the matter was taken up with him?

A. I have not made any efforts in this regard, for two or three reasons, the first of which is that Mr. Bailey having died, I simply came to the conclusion that it might be that his office was no longer carried on and the old records available, which conclusion might or might not have foundation. The second reason is that I have not been personally interested in this matter of searching out records, as it was not part of my obligation to Mr. Henry at the time I sold him this patent to take any such steps at all, and I therefore have not made any effort or exercised any diligence in this matter of searching for proof of date of the invention further than by communications from a few people whom I could easily reach, indicating that the date of invention was within certain limits of time.

XQ. 416. Do you know when Mr. Bailey, the patent attorney, died?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent, and not cross-examination. The present witness is not competent to testify as to the fact, and if he were it would have nothing to do with the case. The best evidence would be the mortuary records within the district within which the gentleman died, and we object to this line of cross-examination which is predicated upon the presumption that Mr. Lyndon, the witness, has been in cahoots with the complainants in carrying on this suit or preparing for the bringing of this suit, the

record showing clearly that the witness did not know against whom the suit was brought until he arrived in Los Angeles last week, and the record also clearly showing that it was no part of the transaction between Mr. Henry and the witness involving the transfer of the patent in suit that Mr. Lyndon should dig up any evidence for the complainant's use in this suit, or in any other suit other than the patent suit.

Mr. Westall: Attention of counsel is called to Rule 51 of the Rules in Equity which is intended to discourage argumentative objections of the kind which has been made, and notice is hereby given that the cost attendant upon such objections will be taxed against the complainant under the rule.

Mr. Blakeslee: We desire to have the Examiner keep this rule firmly in mind, and if he is not able to see that counsel's objection is not argumentative but rather a statement of bases of objection, he is advised to obtain counsel other than counsel for defendant to properly shape his course in the premises within the purview of Rule 51.

A. I do not know when Mr. Bailey died.

XQ. 417. By Mr. Westall: Are you sure at the present time that Mr. Bailey is dead?

A. I have no personal knowledge of his death.

Mr. Blakeslee: In view of the answer of the witness we ask that the question and answer be stricken out and withheld from consideration as frivolous and not tending in any way to establish the fact inquired about.

XQ. 418. By Mr. Westall: Is it not a fact that Mr. Bailey, the patent attorney, in Washington, in whose hands you have said the matter was first placed, did not

proceed with the application for the reason that the matter was not in shape and had not been sufficiently worked out to make an application for a patent at the time that the York Manufacturing Company were experimenting?

Mr. Blakeslee: Objected to as indefinite, calling for a conclusion of the witness, not the proper method of proof, not calling for the best evidence.

A. What Mr. Bailey's own views of the situation were, I, of course, have no means of knowing, as I did not personally ever come in contact with him until I went to Washington in the early part of 1900 to get such papers, sketches and drawings, as he had, in order to carry them to Knight Brothers. The sketches furnished by me to the York Manufacturing Company were amply sufficient for Mr. Bailey's use to draw a patent specification and claims from. Whether the York Manufacturing Company decided that they preferred to manufacture one or two machines and experiment with them prior to taking out the patent, or whether the documents were delayed in transit from the office of the York Manufacturing Company to Mr. Bailey, or whether they were sent promptly to Mr. Bailey and the work of preparing patent application was deferred owing to the press of other business, and the apparent feeling that there was no need of hurry, I can not say. I have been informed that the last state of affairs was the one which actually existed.

XQ. 419. By Mr. Westall: Have you any personal knowledge as to whether or not the fees were paid to Mr. Bailey for any services to be performed in making

application for patent on the device of your alleged invention?

A. No.

XQ. 420. When you went to Mr. Bailey to get the papers from him after the York Manufacturing Company had definitely declined to go on with the work, did you have any conversation with Mr. Bailey concerning the question of whether or not his fees or any part of his fees had been paid?

Mr. Blakeslee: Objected to as placing an arbitrary determination on the testimony of the witness respecting the nature of the terms of the tentative agreement between the witness and the York Manufacturing Company, and as irrelevant, immaterial and not the proper method of proof, not calling for the best evidence on the subject.

A. No. That was strictly a matter between Mr. Bailey and the York Manufacturing Company. I understood that Mr. Bailey was the patent attorney for the York Manufacturing Company, acting on all matters of that character for this company, and that the preparation of patent applications for the water-wheel governor covered by such patent in suit would simply have been a portion of the work which he was continually doing for that company. Whether this statement will have any bearing on the question of fee, I do not know. But the York Manufacturing Company at that time had a capitalization of a million and a half dollars.

XQ. 421. By Mr. Westall: Did you see Mr. Bailey personally at the time you severed your relations with him?

A. I am not sure that I saw Mr. Bailey personally, or one of his assistants. I am inclined to think that it was one of his assistants whom I saw who got up the sketches and written descriptions and delivered them to me. I cannot be sure about this, but that is my impression.

XQ. 422. Had any specification or first draft of the specification been made at the time you got the papers from Mr. Bailey?

A. That I do not remember.

XQ. 423. Can you state just when it was that you got these papers from Mr. Bailey or his assistant?

A. It was between the middle of February, 1900, and the 1st of April, 1900. I can fix this time with fair accuracy, because it was in February, 1900, that I went to Baltimore on some special work which kept me there until October of that same year, and within a very short time after I went to Baltimore on this work I went to Washington and obtained these documents from the office of Mr. Bailey. To the best of my recollection, this occurred sometime in March, 1900.

XQ. 424. Do you remember just what papers you got from Mr. Bailey or his assistant at that time?

A. No, I do not. I only remember that there were a considerable number of papers. Some were my own original sketches; some, if I remember correctly, were suggestions or notations on the margin of either Mr. Bailey or some person in his office, and I am not sure but that one patent drawing had been made. In fact, I now recall that the drawing which formed Sheet 1 of the patent in suit was made up to be used in the preparation of the patent application, and it is obvious from this

drawing that it was made up from rough sketches. So that the work of preparation of the patent had proceeded as far as the making of this drawing. Further than that I have no memory as to the number or character of documents which I obtained from Mr. Bailey's office.

XQ. 425. Could you state approximately how many drawings there were?

A. I have not the remotest idea. My own habit of making rough sketches and then explaining these original sketches by other rough sketches of a more detailed character would lead me to believe that there were a considerable number of such sketches. But I cannot now say that that was the actual truth.

XQ. 426. Do you remember distinctly the drawing which you believe to have been a patent application drawing and which you found among those papers?

A. I do not remember this drawing specifically as one of the drawings that I obtained from Mr. Bailey's office, except inferentially. I know that the drawing was made for a patent application, and in behalf of the York Manufacturing Company. I know that it was subsequently used in my patent application which eventuated in patent No. 695220, and without remembering this to be the fact, I am perfectly assured that I carried this drawing to the Knight Brothers and that I never personally prepared it. Therefore, as I say, my memory of having obtained this drawing from Mr. Bailey's office among the others is not intrinsically true and is only inferentially true.

XQ. 427. How soon after you got these papers from Mr. Bailey or his assistant, sometime between Feb-

ruary and April, 1900, did you take up the matter of your patent application with Knight Brothers.

A. I cannot say; but I know that it was as soon thereafter as I was able to leave Baltimore and go to New York.

XQ. 428. Was it a month after, or two months?

A. It must have been very soon; certainly not over two weeks after I obtained the papers from Mr. Bailey, if my present memory is correct, because I obtained them for the purpose of having a patent application prepared and filed, and I know that I did not defer this any longer than necessary for me to take an opportune time to go to New York. And during the period of my stay in Baltimore I used to go to New York at intervals of from two to three weeks. From this I would state the period of turning the matter over to Knight Brothers, as within three weeks after I obtained the papers from Mr Bailey's office.

XQ. 429. So that you would feel very confident in saying that it could not have been later than the 15th of April, 1900, when you took this matter up with Knight Brothers?

A. I could hardly be that specific, but, as I have before stated, my memory of the time that I went to Mr. Bailey's was in the early part of the year 1900. As far as this memory is correct, just so far would be correct the statement which I now make, and that is that I believe the subject matter of this patent to have been in the hands of Knight Brothers by the middle of May, anyway, 1900, and possibly earlier.

XQ. 430. At the time that you took the matter up

of the application of the patent in suit with Knight Brothers, did you pay any money to Knight Brothers?

A. That I do not remember. I, however, think it unlikely.

XQ. 431. Did you make any arrangement for the paying of their fees at that time?

A. I do not remember; I do not think that I made any bargain with them. My memory is that I simply turned the papers over to them and requested them to prepare and file a patent application, and, knowing Knight Brothers and certain circumstances connected with other patents which they have taken out for me, it is my belief that they called on me at the time of applying for the patent simply for the government fees, and that when the patent was finally ready to issue they then asked me for the final government fees, and then later sent a bill for their services. I believe this to have been the course of the transaction, though I cannot state with any degree of positiveness.

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XQ. 432. Had Knight Brothers previously taken out patents for you, before you placed in their hands the application for the patent in suit?

A. No; this was the first one they ever took out for me.

XQ. 433. Did you ask them at that time what their fees would be?

Mr. Blakeslee: Objected to as having been already gone into, and being repetitious.

A. No; I did not.

XQ. 434. By Mr. Westall: So that you simply

left the papers in their hands, without any definite arrangement or contract of any kind?

Mr. Blakeslee: Objected to as not the proper way of taking proofs. Let the witness be asked what he did, if counsel is not already satisfied, and not to attempt to put words in his mouth or testify for him.

A. Yes.

XQ. 435. By Mr. Westall: You have stated that you do not remember exactly when it was that you took up the matter of getting up working drawings for the device of the patent in suit with the York Manufacturing Company, but that it was early in 1899. How soon after that was it that the York Manufacturing Company took the matter up with Mr. Bailey, the patent solicitor at Washington?

A. That I do not know. I was never apprised by the York Manufacturing Company of this date, and I only know that after the lapse of several months—just how many I haven't now any clear idea—that I called the attention of the York Manufacturing Company to the failure of their attorney to prepare a patent specification and drawings, or to their failure to send me such patent specification and drawings for inspection if such had been prepared.

XQ. 436. How soon after you placed the matter in the hands of Knight Brothers and requested them to make application for a patent was it that any specification or drawings for such patent application were prepared by them?

A. That I do not know. I think it was subsequent to May, 1900.

XQ. 437. Was there then a considerable delay be-

tween the time you placed the matter in their hands and the time at which they prepared this patent application and drawing?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts, and not the proper method of proof.

A. There might have been. I do not remember now.

XQ. 438. By Mr. Westall: You were not then following up the matter very earnestly or with very much interest, were you?

Mr. Blakeslee: The same objection.

A. I, of course, had a considerable interest as to following up the matter. I scarcely understand what I could have done or failed to do that would be indicative of this. I had turned over the information in such form as I considered to be complete and which, apparently, the office of Knight Brothers fully understood; and I further had a realization that they were patent lawyers of international reputation, and had many other things to do besides the preparation of my one patent application. I felt sure from my knowledge of them and their standing that it would be properly and reasonably attended to; and if by not following it up you mean that I did not at frequent intervals call at their office and demand haste, I did not.

XQ. 439. By Mr. Westall: How many times after you first left the matter of the application for the patent in suit in the hands of Knight Brothers did you call upon them or communicate with them relative to the progress of your application?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent.

A. The impossibility of stating anything which might be even relatively correct fifteen years subsequent to the period you refer to, when I have no other circumstances whatever to connect visits to the office of Knight Brothers with, and further, that I was then staying in Baltimore and went to New York only when called there by the people I represented, and that sometimes I would have only one day in New York and would be unable to see any but my principals, and at other times I would have available a day or a few hours before returning to Baltimore, is obvious, I believe. I cannot even remotely conjecture.

XQ. 440. By Mr. Westall: Do you believe that you ever called upon Knight Brothers between the time that you placed the matter of the application for the patent in suit in their hands and the time that the application was sent to the Patent Office, with reference to the progress of the application?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, not the proper method of proof. What the witness believes is not evidence nor a statement of facts.

A. I know I called on Knight Brothers several times during this interval. It is probable, I should say, in fact, inevitable, that I at times discussed the matter of my patent application with them. In order that you may more fully understand, however, that I may have often called at Knight Brothers' office without having entered into the matter of this or any other patent application, it is well to here inform you that the several members of the firm of Knight Brothers were and are all my personal friends, and I have made many calls at

the office of Knight Brothers without having any business to conduct or discuss with them, and entirely for social and friendly purposes.

XQ. 441. By Mr. Westall: Do you know who drew up the specification of the patent in suit?

A. In my discussion with Knight Brothers of this matter, the whole matter seemed to be in the hands of Mr. Percy Knight, although Mr. Harry E. Knight went over the matter at one time. It is my impression that the actual preparation of the application was done by Mr. Percy Knight; but of this, of course, I can not be sure.

XQ. 442. Did you read over the patent specification before it was sent to the Patent Office?

A. I do not remember, but it is my belief that I did, simply based on the fact that it is my custom to read over patent specifications and claims in any patents which I have either taken out myself or which have been taken out by corporations to which I have acted as technical adviser, prior to their finally being sent to the Patent Office.

XQ. 443. You do not recall, do you, that the person who drew the patent specification had any trouble in understanding the device and its method of operation, and came to you for further explanations than those contained in the sketches that you turned over to Knight Brothers?

Mr. Blakeslee: Objected to as assuming a state of facts contrary to those testified by the witness, namely, that the attorneys Knight Brothers relied alone on the sketches and papers brought them by the witness, pre-

paratory to drawing up the specification, claims and drawings of the patent in suit, and, therefore, tending to mislead the witness, and contrary to his testimony.

A. I do not remember that Mr. Percy Knight ever experienced any difficulty in understanding from the sketches and descriptions which I gave him all of the features which later were incorporated in the patent No. 695220. It is my belief that such failure to understand never occurred, both by reason of the fact that the subject matter was in a very complete form, and that Mr. Knight, so far as my judgment goes, has a trained scientific and engineering mind of quick perception.

XQ. 444. By Mr. Westall: So that while your recollection is not quite entirely clear, you believe it may have been possible that that description contained in the patent specification may have been sent to the Patent Office without your having previously read and checked it over to find out whether or not it was correct?

Mr. Blakeslee: Objected to as simply suppositious and argumentative and calling for a matter purely of belief and not for a statement of facts, but rather for the guess of the witness which cannot be evidence in these particulars.

A. Of course, where I do not definitely remember what did or did not occur, any occurrence or want of it which may suggest itself to you might have transpired. It is possible that I did not read the specifications and it is probable that I did, but as to what actually happened I have no present recollection.

XQ. 445. By Mr. Westall: The matter of your application at that time was one of great importance to

you, was it not, and one in which you were deeply interested, at the time, was it not?

A. I considered it to be of considerable importance and I was deeply interested in it.

XQ. 446. Now, after this application was sent to the Patent Office, have you any recollection of any time thereafter, before the grant of the patent, of carefully reading the application and comparing it with the drawings of your patent application?

A. No. I thought I had fully testified on this subject by the statement that I did not remember ever having read the specification, and believed that I had read them only because it has always been my habit to do this. I remember nothing about it. I do not know whether I ever saw them before they went to the Patent Office, and I don't know whether I even ever saw any of the references that might have been cited by the Patent Office in answer to some of the claims, and I am totally without recollection as to whether I did see these specifications and drawings or whether I did not.

Mr. Blakeslee: We object to this whole line of cross-examination on the ground that the best evidence and the particulars inquired about is the record in this case, and the file wrapper and contents of the patent in suit, showing the several parts of the application as filed, including the oath of the applicant, the present witness, as to the invention, and all parts thereof disclosed in and claimed by the application for the patent in suit, such file wrapper and contents including such oath being in evidence under certification of the Acting Commissioner of Patents and being "Complainant's Exhibit B." This

is the best evidence in these particulars, as it is the record of the Patent Office in these particulars. The application is on file and it shows that the prosecution of the application was in the hands of Knight Brothers, attorneys for the witness.

XQ. 447. By Mr. Westall: Now, the file wrapper and contents referred to by counsel in his previous argumentative objection is what appears to have been subscribed and sworn to by you on the 8th of September, 1900. In that oath you have sworn that you believed yourself at that time the sole inventor of the improvements described in the specification which accompanied the oath. Do you mean to say that it is possible you made this oath without having read the specification in order to ascertain whether or not it correctly described the invention which you were endeavoring to patent?

Mr. Blakeslee: Objected to as frivolous and irrelevant and immaterial, not the proper method of proof, not calling for a statement of facts, but being the mere hazard or guess of the witness as to the possibility, and is not tending in any way to prove any of the issues in controversy in this suit, that it is mere record-stuffing and encumbering procedure which is in line with the greater part of the cross-examination of this witness so far developed.

A. I do not mean to make any such statement and am now unable to remember any statement of any kind that I have made that would lead to any such inference.

XQ. 448. By Mr. Westall: Would not the fact that you made such an oath, attached to your original application, conclusively satisfy you that you had read and

examined the specification accompanying that oath in order to understand fully what was contained therein and in order to know that you were not swearing to something which was not true?

Mr. Blakeslee: Objected to on the same ground, that it is a mere self-serving statement and an attempt of counsel to testify without being sworn, and calling for the mere hazard, guess or psychological conclusion, not being the proper method of proof, if there be anything to prove in and about the indefinite subject of the question, and that it merely encumbers the record.

A. As I have previously testified, I am fully satisfied from a knowledge of my usual acts in connection with patent cases that I did read this patent application. I have also testified that I do not have any distinct memory of having done so, when it was done, under what circumstances, or in the company of whom, or at what hour of the day. Further than this I am unable to state concerning the matter of having read the application.

XQ. 449. By Mr. Westall: Were you informed of the first action of the Patent Commissioner before any argument or reply was made by your attorneys to it, and did you advise with your attorneys or consult with them concerning the objections made by the Examiner and communicated by him in the letter of October 29, 1900, which is made part of the file wrapper and contents of the patent in suit in evidence?

A. I do not remember that this Office action ever came before me, nor do I remember any other Office action having been referred to me by Knight Brothers. I cannot state that this or other actions were not mention-

ed to me or brought to my attention, but, if they were, I have no present memory of the fact.

XQ. 450. You have testified that according to your recollection you placed the matter of your patent application for the patent in suit in the hands of Knight Brothers prior to May, 1900. Have you any explanation to offer for the long delay, namely, of from April to the 1st of May, until September, in the taking of any action by Knight Brothers upon your application?

Mr. Blakeslee: Objected to as it assumes the testimony of the witness to be that no action was taken by Knight Brothers during the period of time mentioned, and as merely repetitious, the witness having testified fully as far as his knowledge is concerned with respect to his contact with Knight Brothers during that period in connection with any urging of procedure by them.

A. I am unable to offer any explanation which, it seems to me, would properly come from Knight Brothers. My experience in applying for patents and the experience of corporations which I have at times been connected with in applying for patents, has been such as to cause me to consider that the lapse of such a period of time between the opening up of the subject with the patent attorneys and their preparation of the patent papers, is only a usual and normal period for the accomplishment of this work; and the lapse of this length of time would not induce the opinion that there had been any negligence on the part of the patent attorneys. My experience is, of course, limited to some of the more prominent offices in New York where most of the practice is in patent law, and in which, therefore,

patent applications must receive such attention as can best be given under these conditions.

XQ. 451. By Mr. Westall: Why was it if you read, as you testify you believe you must have read, the original specifications sworn to by you as appears from the file wrapper of the patent in suit in evidence, that you did not notice the important omission in the patent specification and drawings to indicate that any adjustment might be made which would permit the by-pass valve to be normally closed?

Mr. Blakeslee: Objected to as assuming something contrary to the testimony of the witness, namely, that there was any omission in this respect. The testimony of the witness clearly shows that provision was made for adjusting the by-pass so that it could be closed, by means of turnbuckles, shown in the drawings. It is objected to as placing an arbitrary interpretation upon the patent in that respect, contrary to the facts supported by the disclosure of the patent, and, therefore, is misleading. Furthermore, it is objected to as argumentative and as being answered by the previous testimony of the witness as far as it may be answered in its argumentative form, and as attempting to lead the court into a misinterpretation of the invention and a misconstruction of the disclosure thereof in the patent.

A. I never observed at the time, nor has it come to my knowledge since, that that omission was made.

XQ. 452. By Mr. Westall: Please explain why, if an adjustment which would permit the by-pass valve to be normally closed was such an important feature of your invention and was so necessary under certain con-

ditions of good governing, as you have testified, that you did not make some reference in the specification of the patent in suit to the turnbuckles described by you as adjusting means (and which are shown in Fig. 5 of the drawings of the patent in suit), or why they were not later described, or their purpose and function fully described?

Mr. Blakeslee: Objected to upon each of the grounds last made of record, particularly as being argumentative, and an attempt to place an arbitrary and false construction upon the disclosure of the patent, and as improper procedure in each of the respects in this objection named, as not the proper method of taking proof and not tending to establish properly anything pertinent to the issues in controversy, and as distorting the testimony of the witness previously given.

A. The preparation of these patent specifications and drawings was entrusted to the Knight Brothers who, I believed, and still believe, to be capable of guiding inventors, preparing specifications, claims and drawings for this purpose, and it was to their special and expert knowledge which I did not have that I trusted. To my mind the fact that a turnbuckle is specifically an adjustable member and known in the mechanical art as such, and useful for no other purpose, seemed to my mind, which might be termed simply a mechanical mind, to cover the necessity. In other words, I thought the depicting of these turnbuckles sufficiently covered the ground by the obviousness of their use. I would as soon have thought of making the statement in the patent specification that the rope to which the turnbuckles were

attached and which were to move the by-pass valve would have to be strong enough to perform this function and not so weak as to break in attempting it. Also, it would have appeared to me as rational to make the statement that the butterfly valve had to be tight on the shaft, which was moved by these ropes, and that it would not operate if loose on the shaft, as to have made any statement about the object of the turnbuckles. Whether my view is proper as to your point of patent law, is for lawyers and courts to determine. To my mind the entire matter was covered.

XQ. 453. By Mr. Westall: It is a fact, is it not, that the turnbuckles illustrated in Fig. 5 of the drawings of the patent in suit would have a useful purpose to subserve in taking up the slack of the ropes "51", "52" and permitting the by-pass valve to be properly centered even in a plant where it was desired to have the by-pass valve normally half open and where it was not desirable for any reason to economize water?

A. That is unquestionably true. They would be a convenient means of adjusting the valve to its middle position, as you have stated.

XQ. 454. So that it does not conclusively follow that because you have shown turnbuckles in Fig. 5 which might allow a certain limited adjustment of the by-pass valve or which might allow the taking up of a slack in the rope, that these devices would indicate to a skilled mechanical mind or to one skilled in the art that it was your intention that this by-pass valve should be adjusted so as to be under certain conditions normally closed?

Mr. Blakeslee: Objected to as not the proper method of proof, and as merely argumentative and attempting to put words in the mouth of the witness, and as not calling for a statement of facts, and tending to place an arbitrary construction upon the disclosure of the patent and the various adaptations of that disclosure to the various conditions of service and use.

A. It would disclose to anyone fully skilled in the art who has an understanding of not only the mechanical and electrical devices, but the conditions under which water wheels operate, and the variable conditions of water supply from usual streams and rivers, that the by-pass valve would at times take a closed position. The general condition, and the preferable condition, to my mind the most desirable condition, is to have the by-pass valve half open and half closed, and an ample supply of water to take care of the power requirements and enough to waste for good governing. This is a general statement of preferable practical ideal conditions. That these are not always present is true of most water powers, and, therefore, the next best thing is the maintenance of a by-pass valve closed and merely operated in a direction to open.

XQ. 455. By Mr Westall: It is true, is it not, that in the specification of the patent no hint or suggestion is contained that these turnbuckles might be so adjusted as to permit the by-pass valve to be normally closed?

Mr. Blakeslee: Objected to as not proper method of proof and not calling for the best evidence, the best evidence being the disclosure of the patent in suit itself, and as therefore attempting to place an arbitrary inter-

pretation upon the disclosure of the patent in suit and put the same in the mouth of the witness.

A. I have not carefully read the specification of the patent in suit for many years, and I do not remember whether there is any hint of the full purpose of the turnbuckle or not. I do not remember that any statement is made either in the specifications or the claims that by the use of these turnbuckles the valve can be changed from an adjustment in its semi-open condition to an adjustment in which it is closed or to an adjustment in which the closed position becomes its normal one.

XQ. 456. By Mr. Westall: Now, it is true, is it not, that if constructed according to the scale of the drawing (Fig. 5) of the patent in suit, neither of these turnbuckles have a sufficient range of movement to permit any more than a very slight adjustment, no more than would be reasonably necessary to take up any slack in the ropes "51" and "52" or to adjust the position of the by-pass valve, and certainly not sufficient to permit the rotation of the valve stem a sufficient distance so that the normal position of the by-pass valve may be normally closed?

Mr. Blakeslee: The same objection, and that it is calling for a conclusion on the part of the witness and as going into questions of interpretation of the patent disclosure concerning degree, and in this respect it is particularly objected to inasmuch as neither the statutes nor the rules of practice of the Patent Office require patent disclosures of mechanical construction to contemplate matters of degree to the refinement of scale calculation. It is therefore merely argumentative, without

foundation either in fact or law, and particularly in fact, as based upon the testimony of this witness or any other witness in this case; and in this latter respect, particularly, not proper cross-examination and not cross-examination in any respect in rebuttal.

A. If this Fig. 5 be taken as a specific mechanical design and the parts built to a scale relative to that of the drawing, the amount of change in length of the two ropes possible through the action of these turnbuckles would be very small, and certainly insufficient to change the adjustment of the gate opening from that of half-open at normal position to that of being fully closed at normal position.

XQ. 457. By Mr. Westall: It is also true, is it not, that such so-called adjusting means are omitted from Fig. 1 of the drawings of the patent in suit, and that no similar, or any kind, of adjusting means are there disclosed?

Mr. Blakeslee: The same objection, and particularly that the question calls for evidence which is not the best evidence, the best evidence being the disclosure of the patent, and, therefore, the question being merely a self-serving statement, and argumentative, if anything else.

A. There is no similar means of adjustment of the relative lengths of the two ropes, but the ends of the ropes are indicated as carried through holes in the ends of the lever, brought out and tied up alongside the main length of the ropes, which would indicate that whatever adjustment was intended to be made in the gate would be made at these points.

XQ. 458. By Mr. Westall: It is true, is it not, that

a much greater range of movement of the turnbuckles would be necessary if it was desirable to adjust the by-pass valve to occupy a closed position than if those turnbuckles were merely used to take up the slack in the rope or allow the by-pass valve to be slightly adjusted in its normal half-open position?

Mr. Blakeslee: The same objection as made in the last three instances of objection.

A. In practice the turnbuckles would have to be a little, but very little, longer for the purpose of adjusting the position of the valve from half-open to fully closed, than they would have to be when they merely served the purpose of adjusting the valve in its partly open condition. The reason for this lies in the fact that the distance of the by-pass valve from the water-wheel governor in practice would be relatively considerable, and by no means would the parts be relatively adjacent, as indicated in the patent drawing. In the construction of plants, the turbines and their penstocks are frequently located outside of a building, the ends of the turbine projecting into the building; and in the later types of plants the turbines are below the floor of the building and sometimes 20 or 30 feet or even more below the operating floor. Any rope connection from the governor to the by-pass valve, which latter valve should be located as near to the water-wheel inlet as possible, would in such cases take a devious path, passing over guide pulleys, and, while it would be possible, it would not be commercially practicable to pull up these links of rope with a short turnbuckle, if a turnbuckle were used for the purpose; and the difference, therefore, in the length

of the turnbuckle required for such purpose, and for adjusting the valve, would not be very considerable. There would, however, as you have indicated, be some difference.

XQ. 459. By Mr. Westall: But even in a plant where water economy was not an object, such turnbuckles as illustrated in Fig. 5 of the drawings of the patent in suit would be a highly desirable if not necessary means for making any slight adjustment of the by-pass valve or taking up the slack of the ropes "51" or "52", would it not?

Mr. Blakeslee: The same objection as last indicated.

A. I believe that turnbuckles might be helpful in such cases, or certain similar means of adjustment would be required.

XQ. 460. By Mr. Westall: Laying aside the question of the sufficiency of the range of movement of the turnbuckles shown in Fig. 5 of the drawings of the patent in suit to permit an adjustment which would allow the by-pass valve to be normally closed, and reading into the patent, for the purpose of this hypothetical question, "turnbuckles with a sufficient range of movement to permit the closure of the by-pass valve under normal conditions," suppose that such turnbuckles were operated so that the by-pass valve would be kept in a closed position under normal conditions of speed and load, I will ask you to describe the operation of the device of the patent in suit when the load is increased.

Mr. Blakeslee: The same objection, and that it is indefinite.

A. On increase in load the entire mechanism would

be set in motion by the change in the position of the parts of the speed controlling device as has before been described, and motion of the gate shaft would take place to open the gate valve. The clutch "57", "58" under the conditions of the by-pass being set normally partly open and partly closed, would rotate in such a direction as to cause the valve to close. The by-pass valve now being fully closed, motion in this direction can not take place at all, or, certainly over simply an infinitesimal distance. Pin "73" shown as being attached to the sheave wheel "54" cooperates with the contact-making parts "74", "75". This pin when properly adjusted will immediately open contact "74", "75", thereby opening the circuit through magnet "64" and preventing that magnet from being energized. This, as is obvious from the relation of the parts in the patent drawing, prevents operation of the clutch when motion takes place in this direction. Therefore the gate shaft continues to turn, increasing the opening of the water-wheel gates, but the by-pass valve, having reached its limit of motion, does not move.

XQ. 461. By Mr. Westall: What would prevent the by-pass valve from continuing to move, it being remembered that we are assuming now that the by-pass valve is closed and an increase of load requires the opening of the main water gate to a greater extent?

A. There would initially be a tendency to move the by-pass valve in the direction of closure—

XQ. 462. (Interrupting) That would mean that the by-pass valve, being already closed, would have a

tendency to move past closure and open the other way, would it not?

Mr. Blakeslee: Objected to on the same ground, and that it is assuming conditions apparently impossible and that it is putting an arbitrary interpretation upon the patent.

A. It would have a tendency to rotate just as you point out; but in the standard and well-known construction of the butterfly valve, rotation past closed position without fracture of the parts would be impossible.

XQ. 463. By Mr. Westall: Is it your understanding that the butterfly valve shown in the drawing of the patent in suit is of the same general construction as the damper in a stovepipe, for instance?

A. In a measure it is.

XQ. 464. And a damper in a stovepipe can be rotated entirely around its axis, ordinarily, can it not?

A. I believe that is usually the case.

XQ. 465. And it is true of this butterfly valve, as illustrated in the drawings of the patent in suit, that it may be likewise rotated beyond a closed position in either direction or in both directions, is it not?

A. No; the butterfly valve shown in the patent in suit is made up of a rotating plate in a cylindrical pipe. The plate itself is not circular, but is elliptical in form, which means that after having rotated towards its closed position and after having come to a fully closed position, it still does not have the plane of the plate perpendicular to the axis of the pipe, but stands at a small angle with it. The standard butterfly valves for hydraulic use usually are provided with flanges on the in-

terior of the pipe, against which the elliptical plate comes to rest when fully closed. In any case, they cannot be rotated past the point of full closure.

XQ. 466. There is, however, not shown in any of the drawings of the patent in suit any means for preventing this butterfly valve to be rotated past a closed position, unless it possibly be the dotted lines indicated by "48" which might possibly be construed slightly elliptical. Is that correct?

A. That is true.

XQ. 467. Now, in "Complainant's Exhibit C," the by-pass valve "48" is not shown elliptical in form, nor is there anything to indicate that any stops are provided to prevent such valve from rotating beyond the closed position. Is that correct?

Mr. Blakeslee: Objected to as merely argumentative and attempting to place a construction upon the showing by implication rather than by the educing of testimony, having no foundation in the record to support it as a proper question in rebuttal.

A. I would say that the drawing, although it may not be clear at the first glance, would indicate the plate to be elliptical.

XQ. 468. By Mr. Westall: You do not find in "Complainant's Exhibit C," to which you have been referred in the last question, any means of adjusting the length of the ropes "51", "52" to permit the by-pass valve to be normally closed, do you?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent, and not proper rebuttal examination,

and merely argumentative and not calling for the best evidence.

A. There is no means shown for this adjustment, except that the drum "54" may be rotated freely on the shaft till any adjustment of the valve is reached, and on release in its new position will be successfully ^{valve}clutched and unclutched by the electrical sliding clutch "57", "58". Other than this there are no adjusting means.

XQ. 469. By Mr. Westall: Such a rotation of this drum, if it were made, would require a re-adjustment of the pin "73" and would also require a new adjustment of the shaft with relation to the worm "18", would it not?

A. It might require a new adjustment of pin "73", but there would be no change in the relation between the parts of the worm gear "18".

XQ. 470. If the by-pass valve is placed in a position to be normally closed, and if then an increase of load is placed upon the wheel requiring the opening of the main gate, this would, as you have described, be followed by a tendency of the by-pass valve "48" to move past its closed position, and this tendency would be resisted merely by the pressure or friction of the by-pass valve on the side of the pipe. Is that true?

A. Not completely. It is all true with the exception of the use of the word "friction", as the resistance to the motion of the by-pass valve. The disc of the by-pass valve having one of its dimensions greater than the diameter of the pipe, comes in actual pressure contact with the side of the pipe, and the resistance which may be set up to the further motion of this plate is only limit-

ed by the strength of the materials of which the valve is composed, and could in no wise be considered as a frictional resistance. Otherwise, however, your statement that the further motion of the by-pass valve disc is resisted, is correct.

XQ. 471. In case of suddenly throwing on of a great and severe load when this by-pass valve is placed in normally closed position, this tendency of the by-pass valve to move and this resistance to the movement would be likely to result in the breakage of some of the parts of the apparatus, would it not?

A. Not if they were properly designed. For instance, if the proper strength of by-pass valve and operating ropes were provided, the electrical operating clutch "57", "58" could slip continuously around without injury to any of these parts. Of course, if there were considerable movement of the shaft "20" with the clutch engaged and the gate resisting motion, and this were prolonged over any considerable period of time, say of an order of several months, the wear on the clutch faces would be considerable. In fact, it might be so great that the clutch faces themselves would require to be replaced. But under the conditions of the circuit to magnet "64" being opened, after rotation has proceeded through comparatively a short distance,—say 8 to 12 degrees of angular distance—this wear on the faces of the friction clutch is practically nullified.

XQ. 472. Now, you find no hint or suggestion in the patent at any place that these parts should be made strong enough so that in case it were desirable to have a valve in normally closed position that they would re-

sist any such unusual strain that might be imposed upon them, do you?

Mr. Blakeslee: Objected to as calling for an arbitrary interpretation of the patent in suit, and not calling for the best evidence, the disclosure of the patent itself being the best evidence, and that the question is merely argumentative.

A. I would consider the hint that these parts should be of that character as definite as I do the inference that the journals of a machine should be made of proper length and diameter, and provided for being oiled, although there is no statement to this latter effect. The reason why any machine designer would so design the apparatus to have ample strength to resist any such forces, is that under any condition, even if the by-pass gate be kept partly open and partly closed, it does under the action of governing move to a condition of being fully closed. If at the moment of reaching this fully closed position the circuit through magnet "64" were not opened, the stresses which have just been discussed would be set up. It would be appreciated by any competent machine designer that it would be difficult to so adjust the arrangements for the opening of the circuit through magnet "64" to exactly coincide with the point of closure; and even if it were possible, it is very probable that a careless erector of an apparatus would not so adjust it. This would mean that when the by-pass valve would reach its fully closed position, any further rotation of the shaft over that course, without the circuit through the magnet "64" being open, would cause rupture of the parts if they were not sufficiently strong to resist the forces which could be set up. So that in

any case and under any interpretation, the strength of these parts sufficient to resist the pull produced by the sliding clutch and be able to withstand this tendency to rotate even up to complete slippage of the clutch, would be obviously necessary.

XQ. 473. By Mr. Westall: It is true, is it not, that at the only place in the patent drawings where the by-pass valve is shown, its stem "49" is shown, according to the scale of the patent drawings, to be very weak and not at all sufficient to stand any such strain or stress as would be necessary if said valve were placed in normally closed position and an increase of load was placed on the wheel?

Mr. Blakeslee: Objected to as attempting to place an arbitrary construction upon the disclosure of the patent in suit, not calling for the best evidence, the best evidence being the disclosure of the patent itself, and also that it is merely argumentative.

A. If the same scale be preserved and related to the other parts, namely, the number of turns on the magnet, the air gap, the lever arm through which the magnet works, and the size of the clutch operated by it, this stem "49" would be amply large to resist any forces which might be set up by these parts.

XQ. 474. By Mr. Westall: If the by-pass valve is placed in such a position as to be closed under normal conditions of speed and load, in case of an increase of load the device of the patent in suit would not accomplish completely the express objects therein, would it, namely, the overcoming of inertia effects caused by both opening and closing of the main water gates?

Mr. Blakeslee: The same objection as last noted.

A. Under this condition the by-pass valve would in no wise affect the change in the velocity of the column of water in the pipe for a specific movement of the gates from one position to a more open position.

XQ. 475. By Mr. Westall: So that the expression just put as contained in the specifications would be only partially fulfilled by such an adjustment. Is that correct?

Mr. Blakeslee: The same objection, and we insist that this line of examination is manifestly improper, inasmuch as it attempts not to compare structures or functions, but merely to assume the function of a court in interpreting the patent, and attempts to force upon the court hide-bound modes of interpretation and limits of interpretation instead of tending to illustrate the matters in controversy, and this objection and those last made will be understood as repeated to all this line of purported cross-examination without the necessity of specific repetition.

A. The device would be able and prepared to fulfill every condition set forth in the description and specification of the patent in suit. The fact that one portion of the device in operation had reached its limiting position and would go no further, does not to my mind indicate that the conditions and characteristics of the invention would not be fulfilled. The same condition which you mention would occur even when the gate is set in a partially open position as its normal one, if a very great motion of the water-wheel gates is required. Because in the first movement in governing, the distance of the

travel of the different parts of the machine might be such as to close the by-pass while opening the water-wheel gates, during which portion of the operation the conditions would be as outlined. It might be, however, that the governor mechanism would move still further, still opening the water-wheel gates; but the by-pass valve having reached the limits of its travel, could not open any further. In this latter portion of such an action, the conditions would be the same as when the by-pass valve is set in a normally closed position. To my mind the fact that the by-pass valve may be set in a position which is normally closed, so that opening of the water-wheel gates is not accompanied by a further closing of the by-pass valve, even though closing of the water-wheel gates will be accompanied by an opening of the by-pass valve, does not indicate that the functions of the invention are not fulfilled.

XQ. 476. By Mr. Westall: But whether or not the by-pass valve would open wide enough to overcome inertia effects of the water, or would close sufficiently for the same purpose, when the main water gate was either open or closed, would depend entirely upon the design of the particular plant and, particularly, upon the size of the by-pass "47". In other words, if this by-pass was made of sufficient size, as large as the penstock, if you please, it would be possible to take care of all inertia effects, regardless of the extreme nature of the load, would it not?

Mr. Blakeslee: Objected to as fragmentary and not complete, as argumentative, and as a mere arbitrary statement put in question form, and not the proper method of proof.

A. I am sure that it would.

XQ. 477. By Mr. Westall: One of the objects expressed in the specification of the patent in suit is that of overcoming certain opposite effects, namely, the inertia effect of water which would follow the opening of the water gate, and another effect being the inertia effect which might follow the closing of the water gate. It is a fact, is it not, that if this by-pass valve is placed in normally closed position, it does not completely accomplish these objects in that it does not overcome the effect of further opening the main gate upon an increase in load?

Mr. Blakeslee: We do not know in what manner from the record of the patent the by-pass valve opens the main gate, and furthermore, we assume that counsel will sometime terminate standing as expounder of the patent in suit and testifying about it, and will leave to the witness the giving of the testimony. We object to the question again strenuously as being argumentative and attempting to place an arbitrary construction upon the disclosure of the patent and not the proper method of proof, irrelevant, immaterial, misleading and not complete, and not the proper procedure.

A. Whenever the by-pass valve has reached the limit of its motion in either direction, and if thereafter the governor moves the gates of the water wheel in a direction which would tend to continue motion of the by-pass valve past the limiting position which it has reached, then the effect of compensation for inertia of the mass of water in the water pipe will cease.

XQ. 478. By Mr. Westall: If this by-pass is made

of a sufficient size in proportion to the pipe-line, you have testified that the device of the patent in suit would overcome any inertia effects of the water, no matter how extreme were the variations in load. Now, suppose that this by-pass is made of sufficient size to have this effect but is so adjusted as to be normally closed. It is true, is it not, that all inertia effects caused by the closing of the by-pass valve would be taken care of, but that all inertia effects caused by the further opening of the main water gate would not be taken care of, and in such a construction, adjusted as I have suggested, the objects expressed in the specification of the patent in suit, namely, the overcoming of inertia effects caused by both opening and closing of the water gates, would not fully be accomplished?

Mr. Blakeslee: The question is objected to as merely argumentative and as based upon positions apparently contrary to the facts in the records of the case, it not being understood that this witness or any other witness has testified that any inertia effects are caused by the by-pass valve, and as therefore placing a false construction upon the facts of the case, and ^{an} ~~was~~ arbitrary interpretation upon the testimony of this witness and an arbitrary construction upon the disclosures of the patent in suit, not calling for the best evidence and not the proper method of proof, and misleading.

A. If the change in the gate opening opening the gate of the water wheel should take place immediately after a change in the opening of the water-wheel gate tending to close it, then during this period the by-pass valve would act in the same manner as if it were set partly

open and partly closed, even though its normal position would be closed. If the opening of the water-wheel gate tending to close the by-pass valve should take place, at some independent time, and not preceded by such prior closing of the water-wheel gates and opening of the by-pass valve, then, and in this case only, would the by-pass valve fail to compensate for the inertia of the water column, it being assumed that the sizes of the different parts were maintained suitable for proper compensation of the inertia effect of the water column.

XQ. 479. By Mr. Westall: If the by-pass valve is placed in normally closed position and the main water gate is open, upon an increase in load, it is true, is it not, that the by-pass cannot in any way assist in overcoming any inertia effects of the water?

A. Under those conditions and in that ~~position~~ of its travel, which I understand from the question, there would be no compensation for the inertia effects of the water column.

XQ. 480. And, therefore, part of the objects of the device of the patent in suit under those conditions would not be accomplished. Is that correct?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not the proper method of proof, and as placing an arbitrary interpretation upon the disclosure of the patent in suit and as argumentative.

A. Under the limiting conditions of relation of parts which you have mentioned, and the specific motion of the apparatus in one direction, during its motion in this specific direction, namely, to open the water-wheel gates, that portion of the invention which refers to com-

pensation for the inertia effect in the water column would during that period not operate to correct the inertia effect of the water column.

Mr. Blakeslee: We move to strike out the answer on each of the grounds urged in the objection.

XQ. 481. By Mr. Westall: During the course of your engineering experience and since the time of your invention of the device of the patent in suit, how many water wheels have you designed or installed or assisted in the installation of or had a voice in the design, selection or installation of?

A. I have never designed any water wheels, but have been a party to the selection and installation of a fairly considerable number, which number I do not now remember. I have just finished installing six water wheels in the plant at Austin, Texas, about which I have previously testified.

XQ. 482. Have you ever recommended the adoption and use of a form of governor as described in the patent in suit for any of the water wheels which you had any part in installing or recommending?

A. Yes. In the hydro-electric plant which I designed for the city of Lynchburg on the James River, I desired, if possible, to use governors constructed on the lines indicated by the patent in suit. There however was no manufacturer making and marketing these governors, and although I prepared certain drawings and attempted to introduce these governors, I reached the decision that it would be inexpedient to attempt to get new machines made for which no patterns existed, the length of time to manufacture and delivery being indefinite, and

from strictly commercial considerations I was forced to give up the idea. As a general thing, it is improper for an engineer to install a special machine for which no patterns exist, which is not in fairly frequent use, and for which repair parts, if necessary, may not be easily and expeditiously obtained. From all these considerations I finally gave up the idea. Since no manufacturer has made machines in complete accordance with the details as shown in my patent, I have been, in my practice, forced to use the next best thing, which has been governors which produced substantially the same results by different mechanical arrangements than those suggested by myself.

XQ. 483. You have stated that in your opinion electro-mechanical governors were superior to a purely mechanical form of governor. Will you please state to what extent, if at all, electrical governors or electro-mechanical governors are used at the present time?

A. I do not know of any governors of either type that are today being commercially manufactured.

XQ. 484. Can you give any reason for this failure to use what you believe to be a form of governor very superior to those which are now in use?

A. The fact that the people who have been engaged in the governor business have in nearly every case been hydraulic engineers with a limited understanding of electricity and electro magnetic, if any. Secondly, that the production of an operative machine is not proof that intelligence of the officials of the company manufacturing it is as great as it might or possibly should be. And, further, the natural disinclination of any manufac-

turer of a specific apparatus which has become reasonably well known to change radically the character of the apparatus, carrying with it not only a change in all the patterns, designs and shop methods, but also in the instructions to the sales department as to statements to make to prospective customers which might be radically different from those which they had been previously making to prospective purchasers. All these considerations, and possibly others, bear very definitely on the reasons why the electro-mechanical governor has not been adopted in practice, even though it is a far better device. I have personal knowledge of a company manufacturing a certain character of devices, which, however, were not water-wheel governors, that purchased the patent of a far better device than the one they were manufacturing and laid the patent aside, its purchase being simply to prevent competition, and the failure to subsequently use it being based on the ground of business expediency.

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XQ. 485. Is there any governor made at the present time which does not have a returning device to prevent the governor from overrunning?

Mr. Blakeslee: Objected to as stating a conclusion, and therefore calling for an arbitrary conclusion on the part of the witness not calling for a statement of facts and not the proper method of proof.

A. I do not know of any.

XQ. 486. By Mr. Westall: It is a fact, is it not, that the returning device is an indispensable part of a

governor, and that no governor would be practicable without some such means?

Mr. Blakeslee: Objected to as indefinite and on the same grounds as last noted. There is no definition in the question of the term "returning device," and the word "device" must therefore be assumed to be a single thing which would return something, and in this question and the last, it attempts to put also an arbitrary interpretation on the testimony which has referred to a device or organization having a returning function.

A. So far as my own knowledge goes, I would consider some form of device for the prevention of over-running of the water-wheel gates and which, I understand your question to refer to when you mention "returning device", to be indispensable. It may be that there are methods of design and arrangement of parts unknown to me by which good governing could be accomplished without such device; but in the light of my present knowledge I would not know how to accomplish such governing without a device of this character.

XQ. 487. By Mr. Westall: You consider your knowledge on the subject quite extensive and your experience sufficient to qualify you to speak authoratively on the subject, do you not?

Mr. Blakeslee: Objected to as calling for a conclusion of the witness and not for a statement of facts, and not directed to determining what the knowledge of the witness is, but merely what he considers it is.

A. Yes; I consider that I have a reasonably thorough knowledge of the art of governing of water wheels.

XQ. 488. By Mr. Westall: Briefly, what is meant by "governor overrunning", or "overrunning of the governor"?

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony extensively given heretofore by the witness.

A. The term "overrunning" as I have used it is meant to indicate a movement of the water-wheel gates past the position to which they should be moved whenever a change in speed occurs. This is in distinction from the movement or attempted movement of the governor when the gates of the water wheel have been fully opened or fully closed to continue motion in the direction of further opening or further closure of the gates. This latter action or attempted action I have referred to as "over-travel," and overrunning does not refer to this action of the machine, but simply to the movement of the gates under change of speed past the position to which they should be moved, but which movement is well within the limits of gate travel.

XQ. 489. By Mr. Westall: Are these sketches contained within the cover marked "Complainant's Exhibit Lyndon's Early Construction Sketches and Identifying Affidavit" in the same condition, so far as marking and sketching is concerned, as they were when originally made, or has anything in the way of marking been added thereto?

Mr. Blakeslee: Objected to as misleading if the question is to be understood as including the markings which counsel is aware to have been placed on by the witness for the purpose of identifying parts during the proceedings. We assume he excepts these from his question.

A. With the exception of the wording written on the sketches Nos. III and V at the time when I was testifying concerning these sketches on direct examination and as instructed by counsel, these sketches are identically in their original condition. I find, however, written on Sketch I in a handwriting other than my own "applies to No. 15 and 16." I also find on the Sketch II in a handwriting other than mine, "applies to No. 17." These notations I believe to have been made in the draughting room of the York Manufacturing Company, but I do not know when or by whom they were made.

Mr. Blakeslee: We again state that we do not assume that counsel wishes to confuse the record by assuming that the lettering on these sketches which the witness has placed on in his examination were on these sketches prior to such time.

XQ. 490. By Mr. Westall: There has never been a model or device of an electro-mechanical water-wheel governor constructed in accordance with the drawings and specifications of the patent in suit, has there?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness, in the first place; that it assumes knowledge by the witness as to which he is not interrogated; and, in the second place, that it assumes an arbitrary interpretation of the invention and of the construction of a mechanism embodying the same and all of the same, prior to the possibility of testifying as to whether such model or organization included such invention or embodied the same.

A. I do not know from having seen one that a water-wheel governor has ever been constructed in accordance

with all of the disclosures of my invention. I consider that nearly all of the operative governors which I know or which I have any information concerning, make use of some one or more of the elements which I have disclosed in the patent in suit. That is the answer to your question on the assumption that you refer to principles of governing. If you refer to the construction of a governor using all of the principles of governing which I have revealed in this patent, and, furthermore, the specific design of parts disclosed in it and using electro-mechanical means of operation, together with electro-magnetic speed-responsive devices. I do not know of any governor made in accordance with all of these surrounding conditions that was ever completed, although, as I have previously testified, most, if not all of the parts of one, were made, but never assembled.

XQ. 491. By Mr. Westall: Has there ever been constructed to your knowledge an electro-mechanical water-wheel governor comprising the combination with means of operating the water gate in either direction, a by-pass for the water wheel, and a valve controlling said by-pass, of means connected to the water-gate-operating means and operating the by-pass valve inversely to the operation of the water gate?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness as to an arbitrary structural proposition, not the proper method of proof and not a comparison of structure with structure.

A. Not to my knowledge.

XQ. 492. By Mr. Westall: Without quoting in its entirety the language of claim 7 of the patent in suit

(which I now place before you), I will ask you if you have ever known of an electro-mechanical water-wheel governor containing within it or comprising the combination of elements of said claim 7 or to which the language of claim 7 might otherwise be properly descriptive and applicable?

Mr. Blakeslee: Objected to on each of the grounds last mentioned, and as attempting to place an arbitrary interpretation upon the patent or the portion thereof reflected as to its meaning and import by the claim referred to, not the proper method of proof and not cross-examination.

A. I do not personally know of any water-wheel governor such as you describe in your question.

Mr. Blakeslee: We move that this answer be stricken out and withheld from consideration as to each part and parcel thereof upon each of the grounds of the objection urged.

XQ. 493. By Mr. Westall: Have you ever known of a governor for water wheels employing as a speed-sensitive device or containing within it as part of its mechanism a dynamo wound to maintain constant potential for varying currents therein but to vary the potential in a greater ratio than the speed?

Mr. Blakeslee: The same objection as last noted.

A. I do not now recall any governor having such speed-controlling means.

XQ. 494. By Mr. Westall: Have you ever heard of an electro-mechanical water-wheel governor containing within it as part of its mechanism a reversing clutch gear adapted to connect the water-gate-operating shaft and the driving shaft in reverse driving relations?

Mr. Blakeslee: The same objection.

A. Yes. The Geisler governor which at one time was manufactured by the Stillwell-Bierce & Smith-Vaile Company, now the Platt Iron Works of Dayton, Ohio.

XQ. 495. By Mr. Westall: Do you remember approximately when you heard of such a device and when it was made and used?

A. I have seen these governors in operation and, as nearly as I can remember, the first one I ever saw was in 1901 or 1902.

XQ. 496. There has never been constructed to your knowledge any electro-mechanical governor containing the precise number of magnets, solenoids, arrangement of contracts and circuits such as are illustrated in Fig. 1 of the patent in suit, has there?

Mr. Blakeslee: The same objection.

A. Never to my knowledge.

XQ. 497. By Mr. Westall: So that your explanation of the construction, operation, and of the effect, is based rather upon theory than upon any opportunity to actually observe the precise assembly of means as disclosed in the patent in suit, in operation?

Mr. Blakeslee: Objected to as indefinite and not calling for a statement of facts, and merely argumentative.

A. That statement is true providing you mean by the word "theory" the application of knowledge gained by observation of each of the different elements working as portions of other kinds of apparatus, and in which a definite knowledge of the action has become so complete as that all of the forces acting and the required

strength of all the parts are subject to mathematical calculation.

XQ. 498. By Mr. Westall: Have you ever estimated what it would cost to construct a model built in substantial accordance with the description and with the drawings of the patent in suit, by which I mean employing the dynamo described, the precise number of contacts, magnets, clutch-gears, solenoids and other devices as illustrated and numbered in Fig. 1 of the patent in suit?

A. I have frequently made such estimates and have actually had portions of such governors made, and have actually discovered by a process of having them made, and paying for them, what some of these portions would cost, so that in this way I have had a reasonable check on my estimates of cost of constructing one or two machines. As to the cost of constructing a large number of machines, this would depend so much on the number to be made of any one size or type that it would be difficult to form an estimate of the cost of manufacture of the machines as compared with the cost of building the machines.

XQ. 499. Please state what your estimate of the cost would be to construct ^{in fact} a model for the purpose of demonstrating the practicability of the device of the patent in suit, such model being constructed as described in my last question.

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, and not tending in any way to prove or disapprove any of the issues of this controversy, and as indefinite.

A. If by "model" you mean a sample machine capable of operating in actual practical service, I have figured that it would cost between \$1200 and \$1800 to make a small governor of a size which would be known in the trade as one having a capacity of 5000-foot-pounds. It is my belief that such a governor could be manufactured at a cost of not over \$325 to \$350, although to build an ~~additional~~ ^{initial} one would cost from four to five times this amount, and possibly more. As an illustration of what I mean by a 5000 foot-pound machine, the water wheels I have just placed in the plant at Austin, Texas, are 3000 horse-power, and the size of the governor for each set of wheels is a 17,500 foot-pound machine.

XQ. 500. By Mr. Westall: You have stated that at that time the various parts of the governor built in substantial accordance with the specifications and drawings of the patent in suit had been constructed but the parts were never assembled. Please state how nearly that model was completed before the project was abandoned.

Mr. Blakeslee: Objected to as assuming it was a model, and as not shown what "model" is intended to mean in this question. And that it is not in accordance with the previous testimony.

A. The apparatus under construction concerning which I have testified was a 5000 foot-pound machine. How far it was completed, I cannot say, except from memory of correspondence, because I never went to Kutztown while this machine was being constructed, and I therefore never saw the parts which were made there. I do know, however, that I did have a dynamo complete-

ly constructed and it was specially built by the Connecticut Motor & Dynamo Works. I also had a controller built by the Ball Electric Company of New York. These parts, however, were useless without the other portions of the machine, which, owing to the circumstances that I have previously testified about, never were completed.

XQ. 501. By Mr. Westall: These parts were useless, were they not, to the persons having them under control upon the abandonment of the project?

A. Yes; forming portions of an incomplete machine, they were necessarily of no use for any other purposes.

XQ. 502. Why was it not practical for you to secure these various parts and add those that were missing, in order to have a device which might demonstrate the practicability of the device of the patent in suit, and thereby enable you to sell the patent?

Mr. Blakeslee: Objected to as assuming facts not testified to by the witness and as misleading, namely, that the invention required such demonstrating for the purpose of selling the patent.

A. I have already explained that the portions built by the Kutztown Foundry & Machine Works were not built for me nor on my order, but were built for one W. A. Ross, who had other transactions with that same company, and of considerable magnitude, and owing to the differences between Mr. Ross and the company the company declined to deliver to Mr. Ross any of the then undelivered products it had manufactured for him. Manifestly, it was not a situation in which I could take any part. Later I opened negotiations with the Kutztown

Foundry & Machine Works looking for the purchase of these parts, for the very purpose that you have outlined. I then attempted to find a purchaser for the governor, and while I could find many engineers who agreed that the principles of my machine appeared to be of the best, they preferred to purchase from established manufacturers, possibly less efficient machines, which manufacturers could supply repair parts as the necessity would arise, without delay, and who were sufficiently financial responsible to take care of any defects in a governor, due to mechanical imperfections or flaws in material, and the possible resulting damages from accident which might come and which occasionally do come from just such conditions of mechanical defects. I suppose that there were other considerations such as the fact that it appeared that an order placed with a man in consulting professional practice without any factory and who had other interests to which he was obliged to devote most of his time, might also militate against securing a perfected device within a reasonable period of time. Whatever the mental processes of these various people to whom I offered the experimental governor were, they were sufficient to them, and I was unable to sell this machine. It would have been of no possible value to have assembled the machine on the floor of the manufactory. It could no more have proven itself effective without direct application to some water-power plant operating under fluctuating load, than would the terms of the patent specifications prove it to be a satisfactory device. If I had been the owner of a manufactory making those kinds of machinery, to which established business the

purchaser might turn at any time, I could probably have disposed of this machine. But under the conditions as they existed, it was not practical for me to do so. Therefore, it never seemed worth my while to purchase the parts from the Kutztown Foundry & Machine Works, and to the best of my knowledge and belief those parts are in the works of that company today.

XQ. 503. By Mr. Westall: It has been found necessary by the witnesses who have preceded you in testifying in the case to read in certain mercury contacts at places where they are not indicated or are not shown or described in the patent in suit. These mercury contacts, with their adjustments, are attempted to be illustrated and added to the patent disclosure in "Complainant's Exhibits AA, BB, CC" and perhaps others. Will you please state whether you agree with the witnesses to whom I have referred as to the necessity of supplying these devices to the patent in suit in order to form an operative structure, stating fully your reasons for any opinion you may express.

Mr. Blakeslee: The complainant objects to counsel attempting to summarize the testimony of any witness or witnesses who have appeared heretofore in this case, and his attempt to place an arbitrary interpretation upon such testimony of such witnesses; and we object to the question and to the witness being called upon to answer it, unless he be confronted with the testimony, if such there be, attempted to be condensed into the question, and we further, therefore, object to the question as incomplete, fragmentary and improper, stating a conclusion, and not voyaging in the direction of proper proof.

A. It will be necessary for me to know just what the witnesses you have referred to have said, before I can either affirm or deny their statements. It is understood, of course, that the means disclosed in the patent are diagrammatical or indicative and not specific mechanical designs. For instance, the contact "40" and "40a" is shown as a single-pole contact, while in the drawings "Complainant's Exhibit AA, BB and CC," blueprints, they are shown as double-pole contacts. This difference is not an actual difference at all, so far as the operation of the machine and the means of operation are concerned. An electrical contact when open tends to spark. By a proper adjustment the sparking, when the contact is broken at one single point, may be made ineffective and harmless. It, however, is easier to make a double break to keep the ^{ac}contacts from sparking. This is a mere variation in electrical design and, so far as I understand the matter of the disclosure of an invention, does not bear on the patent in suit: I mention this as an example of the variation indicated in the said blueprints from the actual single mercury contact shown in the patent drawing. As stated before, however, I do not know what testimony has been offered with respect to these blueprints. and it therefore is impossible for me to comment on any statements of previous witnesses.

XQ. 504. By Mr. Westall: Do you understand fully the construction, purpose and object of the devices illustrated in "Complainant's Exhibits AA, BB and CC," and their application to the patent in suit?

A. Not at the present moment. I have never before studied these, but believe with a few moments' attention to them I can reach a full understanding of them if they

truly represent devices to fulfill the functions called for in the specification and claims of the patent here in suit.

Mr. Westall: The witness may take sufficient time to examine and compare the blueprints referred to with the patent, in order that he may understand them before attempting to testify.

Mr. Blakeslee: In view of the last answer of the witness, we object to this question as not cross-examination.

A. I now understand the blueprints "Complainant's Exhibits AA, BB, CC," and the functions the device shown in these exhibits is intended to perform, and the relation to the patent in suit.

XQ. 505. By Mr. Westall: Will you please describe your understanding of those blueprints and their relation to the patent in suit as you understand it?

X A. The double-pole contact "40", "40a" shown in the blueprints, corresponds to the single-pole contact "40", "40a", shown in Fig. 6 of the patent drawing in suit. The double-pole contact "41", "41a" of the blueprint corresponds to the single-pole contact "41", "41a" of Fig. 6 of the patent in suit. The single-pole contact "45", "45a" of Fig. 6 of the patent in suit finds its counterpart in the two double-pole contacts "45", "46" and "45a", ~~46~~^{46a} which numberings represent the equivalent of one single-pole contact. And "100", "101" and "103", "104" each numbering indicates a double-pole contact which is the equivalent of a single-contact. In Fig. 6 of the drawing of the patent in suit the contact "45", "45a" closes the circuit through the magnets "64" and "32". These single contacts all being indicated in Fig. 6 for the sake

of simplicity instead of the double contacts, and the separate circuits of magnet "32" and magnet "64" as actually shown in Fig. 1 of the patent in suit. By reference to Fig. 1 of the patent in suit it will be observed that all of the contacts are double-pole contacts, and that the lever "43" carries two pairs of such double-pole contacts, and in this way the number of contacts and their relation shown on the blueprints before referred to are in accord with the number of contacts and their relations shown in Fig. 1 of the patent in suit.

XQ. 506. What do you understand to be the purpose or object of the illustrations of the mercury cups and contacts, the mercury in the cups being shown at different levels and the contact rods in some of the illustrations being dipped into the mercury and in others being raised above it, as illustrated in "Complainant's Exhibits AA, BB and CC."

Mr. Blakeslee: Objected to as not cross-examination.

A. As I understand these three blueprints, they are meant to illustrate three successive positions of the different portions of the device. The difference in the levels of the mercury cups, is for the purpose of causing certain of the circuits to open before others of the circuits open, and cause certain of the circuits to close prior to the closing of other circuits. It is, of course, possible to adjust the level of the mercury in each of the cups to give this variation in time of opening and closing the circuit as indicated in these drawings. In my own designs I find it preferable, however, to make the projecting points attached to the levers adjustable by means of nuts above and below the levers screwing onto the threaded portions of the stud. But the principle of each

is the same. Blueprint "AA" shows conditions of normal speed of the water wheel, normal voltage of the controlling dynamo parts of the speed-controlling device in a normal and neutral position, no contact points touching the mercury, all circuits to magnets open and the governor mechanism stationary. Blueprint "BB" shows a condition of a reduction in the speed of the water wheel and a diminution in the voltage of the controlling dynamo, the pull of the solenoid on core "34" being correspondingly reduced, and the pull of spring "38" overcoming the pull of the solenoid, the downward motion of the right hand side of the lever turning about pivot "26a", contacts "41, 41a" being closed, energizing the magnet on the governor to actuate the clutch, which sets in motion the mechanism to move the water-wheel gates toward an open position. This blueprint depicts the lever either in the state of beginning to move and having closed contacts "41, 41a" or in the state of returning to normal position after governing has been completed and in which latter position it has not yet opened the contacts "41, 41a". In the position shown, the motion has not proceeded far enough to cause the contacts on the end of the lever "43" to close, or, if the parts are in the condition of returning to normal, these contacts have been opened prior to the opening of contacts "41, 41a". Therefore, there is at the instant indicated by the relation of the parts in blueprint "BB" a motion of the water-wheel gate without either of the auxiliary magnets of the governor being excited. In blueprint "CC" there is depicted the still further departure of the parts of the controlling mechanism from the normal or neutral position, and in this position the

main magnet contacts "41, 41a" and the auxiliary contacts "45, 46" and "45a, 46a" are closed. In this position, therefore, one of the main operating gate magnets is energized, motion of the governor is proceeding, and one pair of the auxiliary magnetic contacts is closed and one pair of the auxiliary magnetic contacts still open. A further displacement of the parts of the controller will cause all three pairs of contacts, namely, "41,41a" and the two pairs of contacts on the end of lever "43", to be closed, and thus energizing one of the main operating magnets and both of the auxiliary magnets. When governing is partially completed and the displaced parts begin to return to their normal position, they will move back in the inverse order as given and as depicted in the blueprints: first, the contacts "100,101,103,104" will open; next, the contacts "45,46" and "45a,46a" will open, and then the contacts "41,41a" will open, and with the opening of all three pairs of contacts motion of the governor will cease unless it is again set up by another succeeding displacement of the parts of the speed-controlling device.

XQ. 507. By Mr. Westall: Now, there is contained nowhere in the patent in suit any hint or suggestion that these contacts may be so adjusted as to provide for a succession of energization of the various magnets as you have described, is there?

Mr. Blakeslee: Objected to as calling for a conclusion and not calling for the best evidence, not the proper method of proof, the patent speaking for itself.

A. I do not find in the specification any statement specifically made concerning any such adjustment; and in the drawing it would be only indicated by the nuts

on the studs shown in Fig. 6. I am stating, however, that I consider that these studs would have to be adjustable, and in the controller which I had made by the Ball Electric Company they were so arranged.

XQ. 508. By Mr. Westall: These nuts on the studs and the studs themselves are not lettered in any way or referred to, nor their use or purpose described in the patent in suit, are they?

Mr. Blakeslee: The same objection as last noted.

A. They are not lettered, and as I have stated, I do not know that any mention is made in the specification as to the adjustability of these studs.

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XQ. 509. Prior to your idea of the construction and operation of the devices illustrated in "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," you had not seen these blueprints, and you had not read any testimony of witnesses who had preceded you in the case concerning them or concerning the construction endeavored to be shown by them, had you?

A. I had seen the blueprints, but merely seen them; I had not studied them to determine just what actions they were intended to show. I did not know, and still do not know what has been testified concerning these blueprints and the devices which they represent, by other witnesses, further than the statement that has been made to me that one witness testified that the Girard governor was an excellent device.

XQ. 510. And the fact that you had not had any opportunity to examine "Defendant's Exhibit Berry Blue-

print No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," accounts for your not being able on sight to fully understand the construction and operation of the devices illustrated in the exhibits referred to until an explanation thereof had been attempted and had been made by counsel for complainant in this case. Is that correct?

Mr. Blakeslee: Objected to as assuming or attempting to force an arbitrary construction of the testimony and record in connection therewith of this witness, and as assuming that any explanation was given to the witness whatsoever, the record showing that the testimony of the witness was given with respect to these exhibits upon his own perception and as a qualified engineer, of the construction and inter-relation of the parts and devices disclosed in these exhibits, plus assumptions of construction and operation and inter-relation put before him and upon which definite questions were predicated, and as merely argumentative and not the proper method of proof, irrelevant and immaterial. The record speaks for itself and is the best evidence as to the procedure in these matters by both counsel and the witness.

A. If I remember correctly, the explanation made me was simply to clear up an ambiguity which arose about the character of the drawings, and I do not now recall that any explanation of the mechanical operation or functions was made me. Obviously you are in the main correct in your statement that I would have been able to have explained the operation of the devices disclosed in these drawings or prints to which you refer, without hesitation, if I had previously studied them and had previously fully understood them. And, without

having done so, it would naturally require a little time to follow out the indications of the drawings and to get well in mind the inter-relation of the various parts so that I might be able to testify as to the operation of mechanism built in accordance with these drawings or prints.

XQ. 511. By Mr. Westall: Have you since that time read any of the testimony concerning the construction illustrated in either of the exhibits referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1?"

Mr. Blakeslee: Objected to as indefinite and not shown whether the question concerns the testimony of witnesses including the present witness, or the testimony of other witnesses than himself.

XQ. 512. By Mr. Westall: I mean the testimony of any witness who preceded you in the case and whose testimony was taken before you were sworn as a witness in the case.

Mr. Blakeslee: Objected to as irrelevant and immaterial.

A. No. I have not read any of the testimony in this case at all, and I have not been informed as to the testimony in this case except a few casual references that I do not now recall, with the single exception of one page which I read here yesterday which referred to the action of the by-pass valve. I did not glean from the testimony where the valve was located, or by whom the testimony was given. It was simply read casually, while waiting for a question to be asked me.

XQ. 513. By Mr. Westall: And concerning what

by-pass and in regard to what construction was this testimony?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not the proper method of proof and indefinite.

A. That page of the testimony which I read did not state the type of valve nor the location nor how it operated, nor do I remember who the witness was. As I stated, it was merely a casual reading in passing a few moments waiting to be questioned. I judge from the few lines that I read that it referred to a plug-cock type of valve. This, however, was inferential, and based on the questions and answers that appeared on this page of the testimony.

XQ. 514. By Mr. Westall: Can you summarize, in a general way, what the purport of that testimony was?

Mr. Blakeslee: Objected to as irrelevant and immaterial, and calling for a conclusion and not the proper method of proof.

A. The purport of that testimony was that the valve had given trouble, first, because of grit or sand in the water. The valve had afterwards been difficult to operate because of the fit in its surrounding seat was too close. That later a looser fit was made, or, as the witness expressed it, the valve was "relieved," from which statement I judge him to have meant that a looser fit was made. And after this change in construction some of the difficulties, if not all of them, disappeared. As I have stated, my reading of this page was casual, and that is all the impression that it made on me.

XQ. 515. By Mr. Westall: Did you read this testi-

mony during the time you were answering questions, or between the times you were answering questions on cross-examination or on your direct examination?

A. It was during the cross-examination.

XQ. 516. And was it in the forenoon or in the afternoon?

A. I believe it to have been in the forenoon, or possibly just as the question of adjournment at the noon hour came up. I cannot now state definitely.

XQ. 517. Was it before adjournment or after adjournment?

A. I believe it to have been just before adjournment.

XQ. 518. Who gave you this page of the testimony to read?

Mr. Blakeslee: Objected to as assuming a fact not testified to by the witness, namely, that it was given to him by anybody. Let the witness be interrogated consistently about this, and let the endeavor not be made to lead him into a trap by unfair assumptions.

A. It was not given to me by anybody. The transcript of a great deal of the testimony was lying on the table where much of it still is now, and I picked up one of the sections of this testimony and opened it, and happened to open it at the particular page that I have mentioned, the number of which or the batch in which it appeared I do not now remember, and I read the few lines on the page which I have before referred to. I would judge that the entire time consumed in this proceeding was within the space of one minute, or possibly less.

XQ. 519. By Mr. Westall: Are you sure from the examination of "Defendant's Exhibit Berry Blueprint

No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1" that at the time you testified you thoroughly understood the operation and construction of the devices illustrated in the exhibits to which I have referred?

A. As far as they are disclosed by these prints, I feel confident that I understand the action. Of course many of the details that bear on the operation of the device which is purported to be disclosed in these exhibits are not illustrated, nor their operation indicated, in which case my conclusions as testified to would be possibly modified if such details do exist and were made known to me.

XQ. 520. Have you ever seen a device constructed in substantial accordance with "Defendant's Exhibit Cobb Blueprint No. 1," and "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness, and not a comparison of structures and not the proper method of proof.

A. No.

XQ. 521. By Mr. Westall: You have never before had an opportunity of observing the structure in which the form of the governor or part of the governor shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1" was used, or any construction which might be generally termed similar thereto, have you?

Mr. Blakeslee: Objected to as calling for and stating a conclusion, and assuming that the thing referred to is or ever was or ever could act as a governor and could operate at all, and calling for a conclusion upon the part of the witness as to the embodiment of any such

purported governor, and not the proper method of proof.

A. I have never seen any such device.

XQ. 522. By Mr. Westall: And have you ever seen connected with any water wheel or part of the mechanism of any water-wheel governor a plug-cock valve used in a by-pass, as illustrated in "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: The same objection.

A. I never have.

XQ. 523. By Mr. Westall: So that all your testimony concerning the operation of this device is based entirely upon theory and upon the few minutes' examination that you were able to make of "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," just before giving your testimony in direct examination on this subject, and is not based upon any opportunity that you may have had of observing the operation of such a by-pass valve or of observing the operation of a governor constructed in substantial accordance with either of the drawings to which I have referred?

Mr. Blakeslee: The same objection, and the further objection is registered, that the question is argumentative. The still further objection is made that the question is repetitious and has been answered on the record by the witness in his testimony as to the inoperativeness of such construction, which renders further questioning pertinent to his having seen any such operative construction improper.

A. I have never seen any such construction, and my conclusion, as given, is all based on theory. To this I

wish to add, however, that it is evident that I have conveyed to your mind the fact that I never saw any of the blueprints or the subject matter of them prior to the beginning of this cross-examination. When I stated that I had never seen them, or, rather, never studied them, I meant to be understood as referring to the governing mechanism, to the valves and to the method of operation of the machine. I had previously looked at and considered the operation of the alleged controlling mechanism shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1." It was the rest of the construction of the governor itself and the water-wheel valves, and other such parts, that I have never examined.

XQ. 524. By Mr. Westall: When did you examine and to what extent and how thoroughly, the construction illustrated in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1?"

A. Thursday night, March 4. The time given to it was, I should say, between five and eight minutes.

XQ. 525. And were you able in that length of time to understand the purpose of the operation of the device shown in Fig 1 of "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: Objected to as assuming that it is capable of any operation whatsoever.

A. It would not be possible for me to determine at all how the device shown in Fig 1 of "Defendant's Exhibit Berry Blueprint No. 1" was intended by its designer to act, unless some explanation were given me of the relation between the annular part "1" and the diamond-shaped piece "7". Without knowledge of whether

these were on the same or different shafts, and whether one was free and the other constrained to rotate, and, if so, which, it would be impossible to determine what the designer's idea was, because there is nothing rational in any possible arrangement of it, and for that reason the natural arrangement of parts which usually may be followed by a trained engineer on a sufficiently complete drawing could not be inferred. I was informed that the diamond-shaped piece "7" was fastened to one shaft, that being the shaft of the water-wheel represented by "8", while the annular portion or the wheel "1" was fastened to the generator shaft, and the motion of rotation or torque transmitted from the drive "8" to the generator shaft through the links "6-6", the levers "2-2". On this understanding of the arrangement, I have testified as to its value as a regulating device.

XQ. 526. By Mr. Westall: Who supplied you with the description which enabled you to testify as to the construction and operation and practicability of the device?

Mr. Blakeslee: Objected to as stating and calling for a conclusion and not in accordance with the previous testimony of the witness, and not the proper method of proof.

A. I do not remember whether it was Mr. Blakeslee or Mr. Henry. One or the other of them when asked by me how this device was intended to be applied, informed me as to which parts were fastened on each of the shafts, as I have just before testified to. No information was given me and no suggestions offered me as to the resulting action of any such mechanism built in the manner previously set forth. On the contrary, my

opinion was then asked as to what would be the result of such a combination of parts so applied to a driver and driven mechanism.

XQ. 527. By Mr. Westall: How much time was consumed in explaining the features of construction and operation of the device illustrated in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1" before you attempted to testify concerning such device?

Mr. Blakeslee: Objected to as misleading and as assuming facts contrary to the very testimony of the witness, namely, that the operation of the device, even assuming that it were operative, was attempted to be put before him at all. His last answer has shown the contrary of any such assumption.

A. The time taken to explain to me how this device was applied to a water-wheel shaft and dynamo shaft could not have been more than the length of time it would require to utter say one hundred words. I should judge that it was all within the period of one minute. How much shorter time than this, I could not say. I do not believe that the entire discussion of this device consumed more than eight minutes, and I believe not more than five minutes.

XQ. 528. By Mr. Westall: So that your previous examination of Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1," of not to exceed five minutes, and an explanation of perhaps a minute, was sufficient to enable you to understand the operation of the device sufficiently, in your opinion, to describe it as fully as you have done in your testimony. Is that correct?

Mr. Blakeslee: I object to the question as misleading, the witness having testified directly against any such

disclosure of purported operativeness and as against the operativeness of this device. We protest against this attempt to return the testimony of the witness to his ears in a garbled form, and tempt him to accept that as his testimony.

A. The length of time that you mention, together with the seven and a half years spent in technical colleges, and some twenty-three years of subsequent experience, all taken together, enabled me to reach a conclusion at the time mentioned and within the time stated as to the forces acting under different conditions and the resulting displacement of the moving parts of such a device. In explanation, I may say that there is not an obscure mechanical action or reaction in the device shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1."

XQ. 529. By Mr. Westall: Are you sure that you now understand perfectly the construction of the bypass valve and its operation and the construction of the water gates and their operation as the same are illustrated in "Defendant's Exhibit Berry Blueprint No. 1"?

Mr. Blakeslee: Objected to as assuming facts contrary to the testimony of the witness, namely, assuming that there is any operativeness attaching to these devices whatsoever, and as stating a conclusion and calling for a conclusion, and not the proper method of proof.

Mr. Westall: I wish my question to be limited, if you do not understand it so, to the construction of the valves themselves and not of their connecting means by which they are operated.

Mr. Blakeslee: The same objection.

A. I understand the general characteristics and the types of valves shown. Undoubtedly there are details of construction which I do not understand, because they are not disclosed by the drawings. For instance, in the water-wheel valves the relation between the plug itself and the surrounding seat appears to be indefinite. In the case of the by-pass valve, while the arrangement of plug and seat as indicated by the section through some point in the axis of the valve is clear, I have no means of knowing what the end arrangements are.

XQ. 530. By Mr. Westall: Referring to "Defendant's Exhibit XX," showing a perspective view of some of the parts about which you have been testifying in your last answer, is there anything in that perspective view or photograph which would enable you to testify more definitely concerning the construction of this by-pass valve?

Mr. Blakeslee: Objected to as assuming any identity between these two showings, and as therefore calling for a conclusion on the part of the witness, and not the proper method of proof and as testimony on the part of counsel attempted to be put in the mouth of the witness.

A. Assuming that the perspective view which you have handed me relates specifically to the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1," and further assuming that the portion lettered "J" in the before-mentioned perspective view is the same by-pass valve, I can now state that I fully understand its general construction as to the end parts. I still, however, am without information as to whether the

plug and seat of the valve are tapered or whether they are of a constant diameter throughout their length.

XQ. 531. By Mr. Westall: Assuming that the plug is of constant diameter throughout its length, will you please describe the device as you now understand it, by a reference to the two exhibits referred to, namely, "Defendant's Exhibit XX," and "Defendant's Exhibit Berry Blueprint No. 1?"

A. The valve case or body comprises a cylinder the diameter of which I am unable to give, which is machined throughout its length. Openings are formed in the body of the cylinder through two of its opposite sides, that is, the center lines of these openings are at opposite ends of the diameter through the cylinder, and the ends of the cylinder are machined smooth also. A plug having a length substantially equal to the length of the cylinder and machined on its periphery so that it forms a smooth cylindrical surface, is placed endwise into the cylindrical casing and is adapted to fit inside of this casing, being rotatable therein. A hole or opening is made through this plug, which enters at one side and passes out at the other side, the center line of the opening, taken from element to element of the plug, corresponding to a diameter of the plug. The length of this opening, compared to the length of the plug, I am not able to say, but proper mechanical design with due regard for economy of construction would require that the length of this opening be at least 75% of the length of the cylinder. On one end of this plug is fastened a shaft, the axis of which coincides with the axis of the plug. A lever is fastened to this shaft and, obviously, movement of the lever will cause rotation of the plug. When the

plug is rotated so that the opening through it corresponds with and registers with the openings through the sides of the surrounding valve body, there is provided a free passage through the entire structure, while if the plug is rotated so that all portions of the opening through the plug on either side of the plug are surrounded by the valve casing, then no passage is provided through the said structure. This latter condition is depicted in the cross-section shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1." These described portions cover all of the parts of the valve excepting the end portions. As indicated in the perspective picture, "Defendant's Exhibit XX," the two ends of the valve are covered by discs or circular plates obviously of cast-iron, the surfaces which come in contact with the end of the case and end of the plug being machined smooth. These discs are bolted in place by the usual mechanical arrangement of studs or machine bolts. One of the discs is provided with a hole through its center, through which the operating shaft may pass, and a stuffing box to prevent leakage appears to be a portion of this device, though this is not clear from any of the pictures or drawings of it.

XQ. 532. Now, we have assumed that this plug within the casing forming the by-pass valve was of the same diameter throughout its length, that is to say, was a cylindrical plug. Is there any indication on either "Defendant's Exhibit Berry Blueprint No. 1" or "Defendant's Exhibit XX," which would lead you to believe that this plug was not cylindrical or was not of the same diameter throughout its length?

A. No. The indications are that it is of the same

diameter throughout its length; and, if it were not, and the plug were conical instead of cylindrical, the drawing Fig. 4 would be incomplete. The perspective drawing "Defendant's Exhibit XX," would indicate that if there were a taper of the plug that this taper would not be considerable, but that the slope of the sides would be comparatively small.

XQ. 533. Would not the fact that the outside casing shown at "J" in "Defendant's Exhibit XX," is cylindrical throughout its length indicate strongly that the plug contained therein was cylindrical and of the same diameter throughout its length?

A. It would be an indication which would warrant that assumption. It, however, is frequently true that where the internal taper of a body the cross-section of which at any point is circular is comparatively small, that is, the slope of the sides is small, the outside of the structure may be made cylindrical simply because of the greater ease of making patterns and castings of that form, and in such case the rough casting would come from the foundry as a cylindrical body both inside and outside, and the internal taper or conical form would be given by machining it.

XQ. 534. In other words, it would take more time, trouble and expense to make the plug and the interior of the casing conical than it would to have it cylindrical. Is that correct?

A. Yes; in a measure that is true.

XQ. 535. Now, in the construction which you have been describing, namely, the by-pass valve illustrated in "Defendant's Exhibit XX," and in "Defendant's Exhibit Berry Blueprint No. 1," there would be no advan-

tage, would there, in having the plug within the casing "J" in "Defendant's Exhibit XX," conical, but there would be a distinct advantage in having it cylindrical, in that it would be more easy to make and there would be less time, trouble and expense in machining the interior of the casing "J" as well as machining the exterior plug. Is that correct?

A. It is partly correct, in that the cost of making parts tapered, would be slightly greater than the cost of making the parts cylindrical. And assuming the same fit to be made between the tapered type of valve and the cylindrical valve and the openings to be the same, the operation of the two would be identical and there would be no advantage of either over the other so far as the working is concerned. But there is a distinct advantage which the tapered plug has in practice, namely, that the tightness of the fit may be adjusted to any desired degree and wear may be compensated for by merely adjusting the plug farther in or out of the surrounding casing. But if your question refers to the respective operation of the two variants of this type of valve, there is nothing to choose between them when the are both adjusted in operating condition.

XQ. 536. Now, a by-pass valve of the plug-cock type, used for the purpose as evidently intended in "Defendant's Exhibit Berry Blueprint No. 1" and in "Defendant's Exhibit XX," would not require any very close or accurate fitting of the valve within its casing? That is to say, the escape of a small amount of water continually through the by-pass valve even when closed, would be of no particular moment? Is that correct?

A. Yes. That is not only true, but I should judge

that the comparative looseness of fit would be absolutely essential to the operation of this valve.

XQ. 537. And that would also be true of the butterfly type of valve which is illustrated in the patent in suit, would it not? That is to say, there would be an escape of some water at all times even when the valve was closed?

A. There is no question but that there would be a slight leakage. The escape of water would be of a negligible order. To illustrate this point more definitely, a butterfly valve in a by-pass having a capacity to discharge 100 cubic feet per second, should not have a leakage of over two to five gallons per minute when fully closed. That is, the percentage would be of an order of 1-100 of 1 per cent of the capacity of discharge.

XQ. 538. Now, assuming for the moment, contrary to the indications of "Defendant's Exhibit XX" and Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1," that this plug within the casing is in slightly conical form and that the means for its adjustment are located outside of the casing adjacent to the disc through which its operating shaft would extend. Will you please state whether or not if the valve were found under one adjustment to work with too much friction within its casing that it would not be easily possible to obviate this friction by reducing, by means of the adjusting means, so as to make the valve to move very easily within its casing, considering the purpose and object of the device and considering the fact that the slight escape of water would be of no particular moment?

Mr. Blakeslee: Objected to as irrelevant and immaterial, and not even upon the hypothesis presented rele-

vant or material to the issues of this case, the assumption being of a structure not before us in connection with the exhibits under discussion, and not tending one way or another to prove or disprove any issues of this case, and as merely argumentative and not the proper method of proof.

Mr. Westall: It is admitted, of course, that the exhibits referred to clearly show this conical form of construction not to have been adopted; but this is simply a hypothetical question which I believe would aid the court in understanding the purpose and operation of the plug-cock valves generally and would, therefore, be pertinent to the issues.

Mr. Blakeslee: If the question is to be viewed in the light of the last admission or statement, or both, the question is further objected to as not the proper method of proof and as not cross-examination, and particularly not cross-examination in rebuttal, the defendant having had its opportunity to present, if it be proper matter in defense, the question of valve types. It is merely an academic discussion without any benefit to the case in view of the structures entering into the exhibits before us, namely, "Defendant's Exhibit XX" and "Defendant's Exhibit Berry Blueprint No. 1."

Mr. Westall: Do I understand by the last remark of counsel that he admits that the construction shown in the exhibits referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit XX" show that the plug within its case is not conical but is of cylindrical form?

Mr. Blakeslee: No. We make no admission. We are simply quoting the admission of counsel for defendant.

Mr. Westall: Would it be counsel's contention that this plug is of conical form, or cylindrical?

Mr. Blakeslee: We will say when we come to the argument what we can make out of the evidence presented in these respects. We are not prepared to limit ourselves at this time by any prediction in that particular.

A. If the plug and surrounding casings were conical and the adjustment which you mention were provided, which arrangement is a very common and usual construction in plug-cocks, it would be easy to relieve the plug of all friction which might proceed from the wedging action, due to drawing it tightly into the surrounding casing. By no amount of adjustment, however, could the plug be relieved from friction that would proceed from the pressure of water against it, as this pressure would remain substantially constant for any degree of adjustment of the plug into or out of the casing within the limits of usual and operative practice.

XQ. 539. By Mr. Westall: And your idea is simply that this water pressure would press this plug down, to get away from technical expressions, into the bottom of its casing, and therefore compel a friction, no matter what adjustment was made with the adjusting means, assuming that it was made in conical form and was not supported in any manner at the end opposite to that in which this operating shaft protrudes?

Mr. Blakeslee: Objected to as indefinite and incomplete and merely argumentative, academic, and not bearing on the issues presented, and not pertinent to the matters now under consideration.

A. Yes; that is true, not only of the plug-cock you have mentioned, but of every type of unbalanced valve

which is known, whether flat-sliding, round-sliding, round-rotating, or any other type of unbalanced valve.

XQ. 540. By Mr. Westall: Now, when you use the term "unbalanced" applied to a plug-cock valve and to a butterfly valve respectively, what do you mean?

A. The plug-cock valve is unbalanced in that a frictional resistance to motion, due to unbalanced water pressure, is set up, and herefore not only the normal friction of the co-acting parts of the valve must be overcome, but also the frictional resistance produced by the water pressure. This frictional resistance taking place over one-half of the area of the valve itself is of an amount and degree proportional to the size and opening of the valve. In the case of the butterfly valve, there is a frictional resistance to motion produced by the water pressure against the disc, but this frictional resistance does not take place over the surface of the valve itself. It simply acts against the bearings of the shaft on which the disc is placed, so that the frictional resistance to motion has such a small lever arm and travels over such a small distance that it becomes practically negligible. In the case of the butterfly valve the forces acting, due to water pressure, are always in balance, and there is no resistance to motion of the valve disc because of unbalanced moments of the forces on the portions of the disc on either side of the shaft. In other words, considering one-half of the disc as being above the shaft and the other half of the disc being below the shaft, the moment of the forces acting around the shaft on the upper side of the disc will always be equal to the moment of the forces around the shaft acting on the lower side of the disc.

XQ. 541. Under your understanding and definition of the term "balanced valve", do you wish to be understood as saying that you consider the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit XX," not to be a balanced form of valve?

A. In so far as your question refers to unbalancing of pressures acting due to water pressure and tending to resist motion of the valve in either direction or ~~tending to resist motion of the valve in either direction or tending~~ to cause motion of the valve, it not being intended to include by these statements frictional resistance, the plug by-pass valve is a balanced valve. The general expression "balanced valve" is meant to convey the idea that there is no substantial change in resistance to motion, whether there be a water pressure applied to the forces or whether there be no water pressure acting on the valve. In other words, the mechanical difference is that a balanced valve is one which is easy to move and the ease of which movement remains substantially constant regardless of pressures to which the valve may be subjected. This use of this term broadly is justified because the object of the use of all balanced valves is to obtain a free-moving valve and one that is not difficult to move, whether actuated manually or mechanically. In this particular mechanical sense, the plug type of valve is not a balanced valve because of the considerable frictional resistance which is usually inseparable from their form of construction.

XQ. 542. For the sake of clarity, I will ask you to state briefly why you consider the type of plug-cock

valve illustrated in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" a balanced valve?

Mr. Blakeslee: Objected to as stating a conclusion contrary to the testimony of the witness, and, therefore, impossibility calling for a statement of facts by the witness.

A. In the sense that it meets the general mechanical understanding of a balanced valve, the plug-cock referred to is not a balanced valve. In the sense that there is little or no resistance to motion of the valve due to the moments of forces tending to rotate the valve in one direction or the other by the action of the water pressure which is passing through the plug-cock, it would in this narrow sense be termed a balanced valve. This, however, would in no wise change the fact that the valve must possess considerable frictional resistance to the motion due to the water pressure and that the force required to move the valve under a very light water pressure must be much less than there is required to move the valve under a heavy water pressure. Therefore, the object of a balanced valve, namely, ease of motion under any water pressure and resistance to motion, substantially independent of water pressure, is not fulfilled by this construction.

XQ. 543. By Mr. Westall: To get right down to the sum and substances of the matter, the reason why the plug-cock valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" you would not consider to answer all of the definitions and requirements of a balanced valve is on account of the friction of the plug within its casing. Is that correct?

Mr. Blakeslee: Objected to as stating a conclusion

and not calling for a statement of facts, merely argumentative, not the proper method of proof.

A. Yes; that would ~~would~~ be the principal objection.

XQ. 544. By Mr. Westall: That really is the entire objection, is it not?

Mr. Blakeslee: The same objection—not those mentioned by counsel, but the objection last mentioned of record.

A. No. There are other objections to this form of valve.

XQ. 545. By Mr. Westall: I am not speaking of objections to the form of the valve, but I am speaking of reasons why it might not be considered a “balanced valve.”

Mr. Blakeslee: The same objection, and the further objection that it is calling merely for repetition, the witness having stated exhaustively with respect to the characterization of this valve.

A. Yes; the friction due to water pressure and to the weight of the plug, even assuming that the pressure between the plug and the case when no water pressure is acting on the structure, is comparatively small.

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XQ. 546. Will you please state why in your opinion the term “balanced valve” is properly applicable to a butterfly valve such as shown in the Lyndon patent in suit?

Mr. Blakeslee: Objected to as having already and distinctly been answered.

A. All the forces set up by the water pressure and acting on the parts of the valve are balanced by equal forces acting oppositely thereto produced by the same

water pressure. Also, the friction which proceeds from water pressure is limited to the friction of the axis of the valve in its journals, and there is no frictional relation between the valve and its seat. Hence the effort required to move the valve with a considerable water pressure on it does not appreciably vary from the effort required to so move the valve with a very small water pressure on it, and, for this reason, it comes within the mechanical ~~expectation~~^{accept} of the term "balanced valve."

XQ. 547. By Mr. Westall: Now, you have been assuming, have you not, that the plug of the by-pass valve illustrated in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" at "41,42,43" is either conical in shape and is adjusted by means outside of the casing at the point where the plug is connected to its operating shaft, and was not in any way supported within the case except by the bearing against the sides of the casing. Is that true?

Mr. Blakeslee: Objected to as indefinite and not specifying in what particulars or relations such assumptions lie.

A. Yes; I have considered it as a valve in which the plug was supported by the casing with which it co-acts. This has been a necessary assumption as, if it were not supported by and in contact with its casing, it would cease to be a plug-cock type of valve.

XQ. 548. By Mr. Westall: You mean to say that if it was supported at the end of the case opposite to that through which its operating shaft extends by a trunnion in a bearing of any kind, so that its periphery would not come in contact, necessarily, with the sides of the casing that it would not be a plug-cock valve?

Mr. Blakeslee: Objected to as indefinite and as assuming an incomplete and fragmentarily disclosed construction, and as assuming a devisible structure with a support at one end and no definition of support at the other end, and, therefore, indefinite and problematical in nature, and as argumentative and not the proper method of proof.

A. If the plug was supported at the end opposite from the end to which the lever is attached, and should swing clear of the surrounding casing, it would, of course, be equally necessary that it be supported on the end to which the lever is attached. The condition of the shaft to which the operating lever is fastened forming a support for the plug would be an unusual structure, and I have personally never known or heard of any such structure. Assuming, however, that I understand your question to refer to a plug supported at both ends upon a trunnion at one end upon which it rotates, adequately supported to take the thrust of the water pressure, and on the shaft to which the lever is attached at the other end, which also passes through a bearing in addition to the side of the box, so that it too may take the thrust of the water, the diameter of the plug at any point along its axis being slightly less than the diameter of the surrounding casing, so that at no point does the plug contact with the surrounding casing, then I would consider that the valve had ceased to be a plug type of valve.

XQ. 549. By Mr. Westall: And your testimony concerning the alleged impracticability of a plug-cock valve in such a position, as illustrated in Fig 4 of "Defendant's Exhibit Berry Blueprint No. 1," would not be applicable to the structure shown in the figure re-

ferred to if the plug of that valve is supported at each of its ends and rotates freely on this axis without contact with the sides of the casing. Is that correct?

Mr. Blakeslee: Objected to as placing an arbitrary interpretation upon the previous testimony of the witness and as stating a conclusion and calling for a conclusion, and as argumentative, not the proper method of proof, and not calling for a statement of facts.

A. As long as there would be no contact between the plug and the surrounding casing and no wedging action between the two by the introduction of sand, leaves, grass or other foreign substances such as are frequently entrained in the water fed to the hydraulic plant, and assuming further that the space between the ends of the plug and the end covers of the valve were sufficiently great to also give an appreciable clearance between the two, and that the amount of water flowing continuously through these clearance spaces both at the ends and around the plug were not too great a proportion of the total flow in the penstock, then the objections as to the high frictional resistance about which I have testified would be practically removed.

XQ. 550. By Mr. Westall: And such valve would be a balanced valve, would it not, with the definitions you have previously given of such a balanced valve?

A. I would so consider it.

XQ. 551. And in that respect it would not differ, so far as principle of operation is concerned, from the butterfly valve, would it?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts and not the proper method of proof.

A. Its operation would not be substantially different from that of the butterfly valve if, as I have stated, no wedge action is produced between the plug and its seat by the introduction of any foreign body. Assuming that the valve is always absolutely clean and there is no possibility of entry of entrained silt which might form a deposit, or any other foreign substance, and the plug and surrounding casing be always free, with respect to each other, then the operation of this valve would be substantially of the same character with respect to frictional resistance as the operation of a butterfly valve.

XQ. By Mr. Westall: And any weight of water in the construction that has been under discussion in the last two or three questions, namely, that in which a cylindrical plug of a by-pass valve is supported and rotates at both of its ends upon a shaft or trunnion, would be borne by the shaft and trunnion in exactly the same manner that any weight of the water would be borne upon the bearings of the butterfly valve upon which it rotated. Is that not true?

A. Yes.

XQ. 553. I call your attention to Fig. 2 of the drawings of "Defendant's Exhibit Berry Blueprint No. 1," to the dotted lines adjacent to the parts or comprising in the part numbered "41,42,43" and "46", and ask you to state whether you understand the construction there illustrated?

A. While the meaning of the lines is not quite clear, owing to the wide distance of separation at the points of the dashes of which the dotted lines are made, I believe I understand the construction there indicated.

XQ. 554. Will you please describe that construction as you understand it and state what the dotted lines are intended to illustrate.

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness as to any intention of illustration. All the witness can do is to make out what he finds there, without knowing what was in the mind of the man who made this blueprint two months ago.

A. My interpretation of these lines is based on the assumption that they represent a by-pass valve operated by a lever, and that the cross-section through this by-pass valve is the same as shown in Fig 4. Whether this assumption is correct or not, I cannot say, but it would be my natural inference from a study of the print "Defendant's Exhibit Berry Blueprint No. 1." This appears to show a rotating valve, but the numbers of the parts in the two figures, namely, Fig. 2 and Fig. 4, for instance, "41" in Fig 2 apparently shows the eye of a lever attached to the operating shaft "42", while in Fig 4 "41" apparently refers to the plug or moving cylindrical portion itself. Now, with the assumption that this difference in numbering on the blueprint is erroneous, and judging as well as I can from the dotted lines, I believe that these dotted lines represent a rotating valve operated by a lever on one end, though I cannot determine whether the operating shaft has any bearing to support it, nor whether it has a stuffing box outside of the bearing. In the absence of the indication, so far as I can see, of a stuffing box, I would be inclined to believe that there was no separate bearing and that the operating shaft "42" does not fit tightly in the hole through the end cover plate of the valve, and through

which this shaft passes, because the absence of a stuffing box indicates that the valve is tight to its periphery. If it is so tight to its periphery, there is no need of a stuffing box. Passing through the plug from one side to the other is the opening which I take to be the same opening as that indicated in the cross-section shown in Fig. 4. On the other end of the valve opposite to that through which the operating shaft passes, there also appears to be a cover plate. In the center of this cover plate is a projecting central portion, and whether or not it forms a bearing for a trunnion, I am not definitely able to say. It looks as if this might be the intention. It, however, is true, that castings are frequently made in this form without there being anything made to fit in the central portion, the reason being that this casting, when not bored through, may be used for end plates without holes through them or, if bored through, become plates through which a shaft may pass with a surrounding boss provided. That is to say, I believe that the cover plates at each end of the valve have been cast from the same pattern. This might have been simply for convenience to prevent a duplication of patterns or parts, or it might have been with the definite object of placing a trunnion in the cover plate opposite to that through which the operating shaft passes. On this latter point the drawing is not quite clear. And before giving an absolute opinion on this part of the subject I would prefer to know what statements, if any, have been made by the previous witnesses who knew what this construction was in practice, and who prepared this drawing. In other words, there might or might not be a trunnion on

the left-hand side of that valve, and the drawing does not clearly indicate which.

Mr. Blakeslee: It is to be noted that this question and answer deal almost entirely with the dotted line showings in the blueprint which are not elevation showings and not, therefore, the best evidence in any respect in drawing practice of shape of construction or interrelation of parts, and the whole question and answer are objected to as being founded purely upon hazard and guess, in spite of the best the witness is able to do on the subject.

Mr. Westall: I suppose that counsel would be willing to have the language he has used in his last objection or statement of record applied also to the dotted lines showing the alleged by-pass valve "48" in the patent in suit.

Mr. Blakeslee: No. My position is this: that there is a vital difference, namely, the purported valve of the "Berry Blueprint No. 1" is attempted to be shown in elevation and section and apparently was a particular feature of the construction which the draughtsman thought necessary to illustrate in body lines, and the best evidence, therefore, is the body line showing that of this purported valve. Whereas the by-pass valve "48" of the patent in suit is shown as a generally well-known type of valve and is then shown, as it is customary to show such things, there being draughtsmen's methods of showing standard constructions without body-line drawing. The distinction is, therefore, that the draughtsman has attempted to show us what this valve is in the blueprint, and that is the best evidence obtainable from the blueprint of what that valve is. The

query is why he did not give us a longitudinal section of this valve.

XQ. 555. By Mr. Westall: Now, a study of the dotted lines surrounding or adjacent to "43" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" shows very clearly, does it not, that the valve is not conical, but that the plug of the by-pass valve is cylindrical?

Mr. Blakeslee: Objected to as assuming that this is a by-pass valve, and as assuming anything from the showing of the drawing of the blueprint, which speaks for itself, and is therefore stating a conclusion.

A. Study of that drawing conveys to my mind the idea that the plug and its surrounding casing are of the same diameter at any point along the axis.

XQ. 556. By Mr. Westall: If you are correct in believing from the drawing referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," that the plug and its casing of this by-pass valve is of the same diameter throughout its length, then it is very easy to assume, is it not, that there would be no reason for the adjusting means of a conical plug on the outside of the casing such as you have described?

Mr. Blakeslee: Objected to as argumentative and not calling for a statement of facts, and as a statement of conclusion based upon the blueprint showing, such as it may be, and not the proper method of proof.

A. Under the conditions you mention there would be no need of any means to adjust the valve longitudinally in its casing.

XQ. 557. By Mr. Westall: And to support the end of the plug opposite its operating shaft on a trunnion in

a bearing would be a most obvious mechanical expedient, would it not, in such a construction as that shown in "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: The same objection.

A. Not in that type of valve. In fact it would be difficult for me to conceive of the arrangement of a rotating valve that was not supported by its seat and did not contact with it. I do not know of any character of rotating valve at all that does not make full contact with its seat along the whole length of the valve and over all that portion of the circumference of the valve which is not cut away to allow a passage of fluids. The construction of a valve which would have a trunnion at one end and a shaft at the other about which it would turn and be supported and at the same time make contact or even a reasonable fit with the valve seat, while not impossible to make would be a difficult mechanical construction; and if the idea of supporting the valve on a shaft had ever come to my mind, as, in fact, it did, when I made the invention, it would have equally removed from my mind, if it had existed, the idea of using a cylindrical plug or rotating portion working and co-acting with a surrounding cylindrical case. In other words, so far as my own judgment and my own ideas would go, I can see no mechanical excuse for making a valve of this type, because of the mechanical difficulties of producing a properly working mechanism. I do not mean by this to state that if such a valve were made that it would be inoperative. It simply would not, to my mind, be good mechanical design, as other and cheaper types of valve would fulfill the same condition, and, at the same time, be free from objections that must obtain with a con-

struction such as you have described. Therefore, it would not be obvious, to my mind, to take a plug valve and then support it on a trunnion and shaft.

XQ. 558. By Mr. Westall: When you first examined "Defendant's Exhibit Berry Blueprint No. 1" you did not examine it carefully enough to know with the positiveness that you now know upon being referred to Fig 2 of said drawing, that the plug within the casing was cylindrical? Is that correct?

A. As I have testified, I was reasonably certain from reference to "Defendant's Exhibit XX," and to the absence of any lines on Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" that would indicate a conical shape of plug, that the plug must be cylindrical. Fig. 2 of "Berry Blueprint No. 1" if I have interpreted the lines correctly, further indicates this, and in this manner it is cumulative, and undoubtedly is another indication additive to those that I have described. I believe that I was clearly of the opinion that the plug is cylindrical before referring to Fig. 2 of the drawing of "Defendant's Exhibit Berry Blueprint No. 1" as I have been since referring to it.

XQ. 559. Would not the fact that the plug of the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" if not supported by a trunnion, and it being in frictional contact within its casing, would be likely, as you have testified, to make such valve difficult of operation, and, perhaps, impracticable, and taken in conjunction with the fact that a trunnion at the end of the plug opposite the operating shaft, both operating shaft and trunnion being supported in bearings, would obviate these undesirable results, and taken in conjunc-

tion with the fact that there is distinctly shown at the point which I have marked "A" in red upon "Defendant's Exhibit Berry Blueprint No. 1," Fig. 2, what might be such a trunnion, lead you to the conclusion that it was very likely the intention of the designer of this apparatus, and it was very likely the construction and operation of the device, that this plug should be so supported and kept from friction with its casing?

Mr. Blakeslee: Objected to as attempting to place an arbitrary interpretation and translation upon the blueprint under discussion, and as merely argumentative, and not calling for a statement of facts, but, rather, calling for a conclusion; and, furthermore, as calling rather than for testimony of expert advice by the witness, which it is too late for the designer of the showing of this blueprint to utilize, however much it might have been to his advantage and the advantage of any persons who attempted to utilize such structure, to follow the advice of the witness as an expert engineer.

A. I would not reach that conclusion, for this reason: The type of valve which is shown in cross-section in "Defendant's Exhibit Berry Blueprint No. 1", Fig. 4, is, to my mind, so obviously an improper construction to accomplish the purpose which a by-pass valve should accomplish, whether it be a plain plug valve or whether it be a circular rotating piece supported on a shaft or shaft and trunnion, that I would not infer that it would be logical or reasonable mechanical design to take any step in any direction with it. If difficulty had been experienced with the operation of the valve as a plain plug type of valve, it would have been the natural and logical thing to remove this valve entirely and substitute some

other form. I would not have considered it advisable or good designing to attempt to rearrange the parts, to produce the structure which you have described. Furthermore, regardless of the quality of the water which would pass through the by-pass valve and its freedom from silt or sand, I would also have feared wedging between the valve and the surrounding casing by some possible floating foreign body such as grass or leaves or small twigs, any and all of which frequently pass through pipe-lines, and although they pass with ease through the water-wheel gates and are not detrimental to the action of the water wheel, the liability of wedging the plug would have appeared to me a prospective and constantly impending danger.

XQ. 560. By Mr. Westall: I believe the witness must not have understood the question fully. What I am endeavoring to ask, is, that taking the fact, if it be a fact, that a plug of the size of that shown in Fig. 4 of Defendant's Exhibit Berry Blueprint No. 1," might be very difficult to operate if it were not supported at both ends ^{of its} by shafts or trunnions, together with the fact that if such a plug were so supported it would be easy to operate, and would obviate all the objections to the lack of balance which you have urged against it, in conjunction with the fact that there is shown at the point which I have marked "A" in red in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," a part ~~of~~ which might be a trunnion and which appears to have been intended for that purpose, leads you to the conclusion that in the construction illustrated in the exhibit referred to it was intended to show and does show that the cylindrical plug

is supported at both ends upon bearings, and does not necessarily come in contact with its casing?

Mr. Blakeslee: The same objection, and, further, that it is going directly in the face of the testimony of the witness which is to the effect that in Fig. 2 such showing as there may be as to this rotating valve indicates a direct peripheral contact of the rotating valve with its casing.

A. As I have testified, the projection shown to the left from the center of the left-hand end cover of the valve, may indicate a trunnion. I cannot state definitely that it does indicate it. I cannot consider this one indication alone. It is necessary for me, in order to form an opinion upon the structure, to consider all of the structure so far as it is revealed by this drawing; and also other drawings which have been submitted in evidence may have the tendency to influence my view of what this drawing does represent. The absence of any stuffing box on that drawing indicates that the plug and surrounding casing are in contact. Also the natural inference that would follow, that this type of valve always has its plug and casing in contact, would require more than ever that an indication of the absence of this contact be shown in drawings, in which case additional lines would be shown which would be parallel to the axis of the plug and very near to the lines which mark the inner wall of the cylindrical surrounding casing. These lines are absent. And while it is also true that in the dotted line indications of a device, that sometimes certain of the lines may be omitted, it is equally true that were these dotted-line drawings mere indications, it would be difficult to decide definitely about the details of the

construction which they are intended to represent. I have had placed before me at another time in this examination the perspective picture of a device which I understand to represent this identical construction as built and installed, and which is marked "Defendant's Exhibit XX." The absence of any trunnion on the side which is opposite to that of the operating lever is so clear that it is difficult for me to conclude that the dotted lines on the drawing shown in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" are meant to indicate a trunnion. It is possible that subsequent to the construction of this device as shown, and in the light of possible experience which may have been had with the attempt to operate this valve, that the draughtsman concluded that a trunnion would be an improvement and actually meant to indicate it. These, however, are mere surmises on my part, and it is impossible for me to speak definitely on these portions of the subject.

XQ. 561. By Mr. Westall: If in addition to the indications which were pointed out in the last question you were told by those who had designed and installed and had actually observed the operation of this device that there was no such friction between the plug and its casing, and that the plug operated perfectly within its casing without any friction, would you be inclined to believe, if you thought such witnesses were speaking the truth, that the part that I have marked "A" on "Defendant's Exhibit Berry Blueprint No. 1" was intended as a trunnion?

Mr. Blakeslee: Objected to as being purely an arbitrary condition which at best can only call for a conclusion on the part of the witness and which may tend to

force an arbitrary construction upon the testimony of other witnesses, not calling for a statement of facts by the witness, but merely a deduction or formation of belief upon his part which is not testimony as to his knowledge, not the proper method of proof, and merely argumentative; and, furthermore, as not taking into account all the working conditions which may or may not have entered into the attempted operation of this device after it left the shop where it was experimentally constructed.

A. As to whether or not I would conclude that a trunnion were placed on one end and supported on a shaft on the other end, would depend on my knowledge of the operating mechanism, for this reason: the operation of a plug valve without any supporting means, even such a one as indicated in the drawing "Defendant's Exhibit Berry Blueprint No. 1," is not an impossibility if the operating means be made strong and heavy enough.

Without knowing whether these operating means were strong and heavy enough to force rotation of the valve and overcome the heavy frictional resistance, I would be unable to agree that there must have been a trunnion in the position you mention. If, however, ordinary, reasonable, commercial means were available, and by that I mean a water-wheel governor of approximately the same size as would be required, if there were no bypass gate to be operated, and were the only means available, and this valve worked rapidly without causing dragging of the mechanism and produced satisfactory regulation, I would then conclude that the plug was supported on a trunnion and shaft as you depict, or supported in some other method, and that it would certain-

ly not be in frictional contact with its surrounding casing.

XQ. 562. By Mr. Westall: In illustrating by the dotted lines the construction of a device in substantially the manner and for the purpose of Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," it is not usual, is it, especially where there are a number of different parts which may make a great number of dotted lines confusing, to endeavor to represent all of the different features of construction, is it?

Mr. Blakeslee: Objected to as calling for a conclusion of draughting practice, and not the proper method of proof of the things purported or attempted to be shown by this blueprint which speaks for itself; not the proper method of proof, and merely argumentative.

A. The degree of completeness of parts indicated by dotted lines is usually personal to the draughtsman. In some practice, specifically Swedish and German, the objects depicted by dotted lines are as complete in their details as if they were shown in full lines. In American practice it is usual to abridge the representation to a certain extent. The dotted line indications of a complete device where it forms a portion of an equipment are usually to show its location on certain of the drawings with respect to the rest of the equipment, it being shielded by some object between it and the eye of the observer. For an understanding of the details of the device it is necessary to refer to specific drawings of the device. From the American point of view a few lines indicative of the location of the device is sometimes sufficient. Frequently, and in most cases, the draughtsmen go further than this and illustrate more of the details, in order

that it may quickly appear to the reader of the print what element of the total equipment is intended to be depicted by these dotted lines, and just how completely the details of the object are revealed, depends upon the personal view of the draughtsman.

XQ. 563. By Mr. Westall: Now, in selecting a butterfly valve for the by-pass valve of the patent in suit, and in rejecting a plug-cock valve, did you have in mind any advantage to be gained by the selection of a butterfly valve over that of the plug-cock valve?

A. No, for the reason that I never even remotely considered a plug-cock valve for the purpose.

XQ. 564. The merits and demerits of the butterfly valve and the plug-cock valve were well known, were they not, at the time of your alleged invention of the device of the patent in suit?

A. Both are well known in the art.

XQ. 565. You have intimated in your testimony, if you have not directly so stated, that the mechanism of "Defendant's Exhibit Berry Blueprint No. 1," sensitive to changes of speed of the water wheel directly operates the means moving the by-pass valve. Now, it is a fact, is it not, that this speed-sensitive mechanism does not of itself act directly on the levers which move ~~up~~ ^{the} water-wheel gates and by-pass valve, but that it only sets in motion by means of a line-to-line valve certain devices which act directly on the water gate and by-pass valve in substantially the same way that the dynamo of the patent in suit sets in motion devices and makes connections which permit the energy of the water wheels to be utilized in operating the by-pass valve and the water gates inversely to each other?

Mr. Blakeslee: We object to counsel attempting to re-testify for the witness, and particularly when he re-testifies without retestifying and therefore object to any metes and bounds and confirmation being placed arbitrarily on the previous testimony of the witness, which speaks for itself. If counsel wishes to recall to the witness this testimony, let him do so in *haec verba*. The question is further objected to on the ground that the question calls not for a statement of facts but for a conclusion as to the alleged operation and inter-relation and inter-operation of parts and features, and attempts to place an arbitrary construction upon the alleged modes of operation, and the like, entering into the performances of the structures referred to, and, therefore, that this is not the proper method of proof, and is merely argumentative and quasi academic.

A. I have never meant to intimate or in any way indicate that the motion of the parts of the device shown in Fig. 1 of the "Berry Blueprint No. 1" was communicated directly to the water-wheel gates and to the bypass valve. Such an inference would mean that there would be no governing mechanism or machinery interposed between this device and the valves other than mere links, or the means of transmission of this specific motion. It is possible that the idea is so definite that any governing mechanism must operate the gates of the water wheel by means of some source of power, which is supplied to the governor, and that the controlling means merely moves some small sensitive and easily moved portion of the governor to set in motion the more powerful devices of the governor mechanism it-

self, and in the proper direction, that I have probably frequently omitted to mention this fact.

XQ. 566. By Mr. Westall: As I understand your testimony, you have never taken up with the Abner Doble Company of San Francisco any question of alleged infringement of your patent, nor have you ever offered such patent to the Abner Doble Company at any time for sale. Is that correct?

A. I do not recall any direct communication from myself to the Abner Doble Company on this subject, although it is possible that I did communicate with it, and although, as I have stated, I do not remember ever having done so, I would judge that I had done so, because I left no opportunity or possibility of disposing of this patent untried. It is also possible that Mr. Messimer may have written to the Abner Doble Company, but this I do not know. It is always, however, assumed among engineers that every company manufacturing any articles or commodities of any character keep themselves fully informed as to the developments in the art which relate specifically to their own industries, and that in every manufacturing company a part of the important records is made up of copies of all available patents on these subjects. This, at least, is the practice of such corporations as I have been connected with or acted as adviser to.

XQ. 567. And would your answer be equally applicable if the name of William A. Doble is substituted for the Abner Doble Company of San Francisco?

A. So far as that portion of my answer refers to whether or not I communicated in person, is concerned, it would apply equally if there were a firm manufactur-

ing water wheels and water-wheel governors under that name and sufficiently well advertised either by paid advertisements in the technical journals or by the magnitude or quantity of their output for their existence to have come to my knowledge. I would also assume that the same statement I have made with respect to manufacturing companies keeping fully advised as to new inventions as disclosed by patents which might bear on the character of apparatus they were making, would also apply to any such firm if, indeed, any such firm were ever existent.

XQ. 568. When you mentioned the Doble Company as one of the companies you had heard were infringing upon your patent, did you mean the Abner Doble Company of San Francisco?

A. I believe it to have been the Abner Doble Company.

XQ. 569. And you never, so far as your present recollection is concerned, ever made any threats to begin suit against said Abner Doble Company of San Francisco?

A. I don't remember ever having made any threats to sue them, and I do not remember whether or not Mr. Messimer ever communicated with them on this subject. I ~~don't~~ know Mr. Messimer's communications on this subject. I have already testified that I paid very little attention to them.

XQ. 570. With regard to the amount of money which you might have been able to raise to bring suit on your patent against the various parties whom you at different times had knowledge or believed to have been infringers, am I correct in understanding that, act-

ing under the advice of counsel for complainant in this case, you decline to state whether you could have raised \$2,000 to institute suit against any of them for such alleged infringement?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, and as having been gone into fully and clearly by the witness previously further than could be deemed necessary or fair, in his answer to such question and it is not proper cross-examination and is a question delving, manifestly, into the personal affairs and personal credit and borrowing power of the witness, which is not to be inquired into, particularly after the witness has frankly answered as to his personal situation with respect to his expenditures.

A. I have already expressed myself and answered this question as far as it has appeared to me to be proper or appropriate. I, however, am willing to answer the question exactly as it stands, provided I am assured by counsel that this step-by-step method of first beginning at \$5,000 and ultimately reaching \$2,000 will not be carried on until an inferior limit of zero is finally reached.

Mr. Blakeslee: And we inform the witness that he need not answer the question at all unless compelled by the court, unless he receives such proper and courteous assurance from counsel.

Mr. Westall: And counsel declines to make any statement further as to his intentions in regard to the matter, and is willing that the matter of the propriety of the question should be submitted to the court at the time of the hearing, if the witness abides by the instruction of counsel.

Mr. Blakeslee: The witness is informed as to what his

rights are, that is, as far as counsel for complainant understands them, and he may do as he deems proper and expedient, unless the court compels him to take a certain course in the matter.

A. Since I am utterly unable in my mind to connect the inquiry with the subject of this suit, after having testified so definitely and fully as to my own decision that I was unable to prosecute a case, which decision might or might not have been justified but which was exercised with the best and most intimate knowledge that I had of the subject, I would prefer to await an order of the court before answering this question, not only for the reasons I have given and because it would seem to be an indication that by an admission of inability to raise \$2,000 were made that another step downward would result until my exact ability might finally be reached, regardless of whether this would bear on the ability to institute a patent suit or not. For this reason I prefer to await an order of the court to answer this particular question.

Mr. Blakeslee: As we understand the question, it is as to whether or not the witness had a certain amount of money which he might have spared to bring a suit under the patent in suit. As this cannot settle the question whether or not that would be sufficient money to carry the suit through, the question cannot be material, cannot instruct the court in any particular, and it is a waste of time to inquire into the personal affairs of the witness which is beyond complacent contemplation.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 571. Referring to "Defendant's Exhibit XX," and generally to the device designated as "J", do you, or do you not find what appears to you to be a stuffing box at the side of the structure, from which that part projects which apparently is intended to operate the internal feature, whether it be a valve, or what?

A. I cannot say absolutely, but I do not find any indication that would show a stuffing box.

RDQ. 572. Then what would the absence of such stuffing box indicate?

A. A fit between the plug and the surrounding casing.

RDQ. 573. For what reason?

A. Because there is no need of a stuffing box if the plug fits the surrounding casing, as, in order for any leakage to take place, the water would have to leak past those portions of the cylindrical surface which lie beyond the ends of the hole through the plug.

RDQ. 574. Inasmuch as you say you do not find any provision for a trunnion at the other side of this casing, what would that indicate in comparing this structure with the structure in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," at the place which counsel has marked "A" in red?

A. The side of the valve marked "A" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," differs from the structure shown in "Defendant's Exhibit XX" in that there is not only no indication in the latter which might even be considered as being possibly a trunnion,

but also there is no hub like projects from the central portion of the cover plate on this end, as depicted in the perspective picture "Defendant's Exhibit XX."

RDQ. 575. Therefore, what is your reasonable engineering conclusion as to what the element is contained within this case?

A. I can only conclude that the plug fitted with the surrounding casing as is usual with plug cocks.

RDQ. 576. And, therefore, if heavy water pressure comes to bear upon this plug, what will be the result of the frictional coefficient as regards governing action or action responsive to a governor, in turn responsive to changes in speed or load, or both?

A. Pressure acting on the valve will be proportional to the head of water acting on it, the diameter of the valve and its length, and the total pressure then set up will produce frictional resistance to motion, which would require a considerable force or effort to cause it to rotate.

RDQ. 577. If the rotating valve, assuming it is such, attempted to be disclosed in "Berry Blueprint No. 1" in Figs. 2 and 4, and heretofore referred to, does not have a tight fit in its casing, but there is an inter-space between it and the casing to permit water to pass around such valve, is it or is it not proper to call it a plug valve?

A. It would depend on whether or not it were otherwise supported. So long as the plug rests in contact with the surrounding casing, even though the fit be so badly made that it does not contact with the casing around a portion of its circumference, it still would, to my mind, be a plug valve.

RDQ. 578. In other words, you mean whenever there is friction between the valve and its seat or case, it would be designated as a plug valve?

A. Practically that. So long as the support of the plug is found in the casing which surrounds it, or a portion of the casing which surrounds it, it would still come in the classification of a plug valve.

RDQ. 579. Now, supposing such valve or device is mounted upon trunnions or in bearings or otherwise positioned so that there is an inter-space clear around it between it and its casing or seat, is it then proper to designate it as a plug valve?

A. I would not think so. My own idea of a plug valve is, as stated before, one which finds its support in its surrounding casing and in which it rotates.

RDQ. 580. If you were informed that this valve we have under discussion in connection with "Berry Blueprint No. 1" had been described by witnesses as a plug valve, what would you assume with respect to it having contact with its seat or casing?

A. I would assume that it had contact with the surrounding casing.

RDQ. 581. What would you assume with respect to its having any bearings or other positioning means upon which to rotate?

A. I would assume that these were not present if it were described as a plug valve, not only for the reasons I have given, but because the plug valve as it is known in engineering has no such positioning means.

RDQ. 582. Is it possible in any sense whatsoever to refer to a butterfly valve or a needle valve as a plug valve?

A. Not in the sense that is accepted in engineering practice.

RDQ. 583. Would a rotating valve on end trunnions clear itself of obstructions such as you have referred to in the nature of grass, twigs, or fine or relatively fine materials entrained in the water supplied to it or controlled by it, with the same facility that such clearance of obstructions would be made by a valve of the butterfly or the needle valve type?

A. Positively not.

RDQ. 584. And for what reason?

A. Because the plug is completely surrounded by the casing at the ends and over the portion of its length up to the edges of the openings through the casing. The space between the periphery of the plug and the inner wall of the casing would be necessarily comparatively small. There is never any change in distance apart of the periphery of the plug and the inner wall of the casing. Therefore, any foreign body which might enter by the operation of the valve as it rotates, and compressively rolled in between the plug and the casing, would not be able to get out nor could it be removed by the usual conditions of water pressure, because no matter how the valve might move, it would never increase the distance apart of the two portions between which the foreign body might be compressed. In the case of the butterfly valve or needle valve the moving member which has this relationship with the other portions of the surrounding body and moves a varying distance away from the different parts of the surrounding body, and therefore a foreign body which would be caught by either of these types of valves in one position would

be automatically released at some other position because the distance apart of the two elements of the valve between which the foreign body was compressed would be increased, allowing the body to free itself.

RDQ. 585. If you were called upon to specify a valve in accordance with the teachings of "Defendant's Exhibit XX" pertinent to the part "J" therein, and the teachings of Defendant's Exhibit Berry Blueprint No. 1" with respect to the parts "41", "42" and "43" in Fig. 4 thereof, and the further teachings of this blueprint with respect to the showing in Fig. 2 of this alleged valve device, what type of valve would you specify, and how would it fit its casing?

A. With these as the instructions before me, I would use the type that comes within the classification of plug valve, which I have previously described, and the plug would fit in the surrounding casing and be supported by it.

RDQ. 586. Referring to Defendant's Exhibit XX" do you find therein any fluid service pipe leading to what appears to be a hydraulic cylinder for operating the purported by-pass valve, and the water-gate valves, and also other service pipes for outflow from such hydraulic cylinder?

A. I cannot find any service pipe such as I understand you to refer to.

RDQ. 587. Would the apparatus be operative without such service pipes, assuming this is a hydraulic cylinder with a piston to move therein?

A. No; certainly not.

RDQ. 588. Do you find any connections shown in

this exhibit whereby such service pipes could be joined with the hydraulic cylinder and its valve case?

A. There is apparently an opening in the top of the valve case for one pipe. It would be impossible, of course, to operate with one service pipe.

RDQ. 589. Do you find any other openings for any other pipes on that device?

A. I do not find any other openings that are visible in this picture.

RDQ. 590. If this were a reproduction of a photograph of this apparatus, would it be a photograph of an operative apparatus with these pipes omitted?

A. No; unless there are openings which are somehow concealed.

RDQ. 591. Do you find, however, any openings or pipes corresponding in position to the openings for pipes in Fig. 2 of "Berry Blueprint No. 1," which lead to the valve casing and hydraulic cylinder or what is purported to be such assembly bearing the numerals "24,25" and "26"?

A. As I have testified that I can find no supply pipes whatever, and only one possible supply pipe opening visible in "Defendant's Exhibit XX", I certainly do not find anything to correspond with the supply pipes shown in Fig 2 of "Defendant's Exhibit Berry Blueprint No. 1."

RDQ. 592. Then is this a blueprint showing of these devices as shown in "Defendant's Exhibit XX"?

A. Not so far as this detail is concerned. If the blueprint is merely meant to be diagrammatic and indicative of the operation of the machine shown in "Defendant's Exhibit XX," and the machine shown in "Defendant's

Exhibit XX" may have some concealed openings not visible, it might be that there would be a correspondence between the two. But the location of any openings for service pipes not being shown in "Defendant's Exhibit XX," the side of the valve chamber being smooth as far around its outer circumference as can be seen, and while in the blueprint three service pipe openings are shown as connected into the valve chamber on the side and directly at one end of the horizontal diameter, it is clear that the blueprint does not exactly represent the devices shown in "Defendant's Exhibit XX."

RDQ. 593. With respect to what we have discussed as purporting to be a by-pass valve and case in "Defendant's Exhibit XX," and also in "Defendant's Exhibit Berry Blueprint No. 1," Fig. 2, and in view of the fact that you find no trunnion showing in the former exhibit, is "Defendant's Exhibit Berry Blueprint No. 1" a correct showing of what is portrayed in this other exhibit?

A. It is not; but the reason does not relate so specifically to the absence of the trunnion, which I am not convinced is shown in the Berry Blueprint; it relates specifically to the hub-like boss at the center of the left-hand valve cover as shown in "Berry Blueprint No. 1," while in the picture shown in "Defendant's Exhibit XX" there is no such boss shown.

RDQ. 594. So there is no boss or trunnion or protuberance shown in "Defendant's Exhibit XX?"

A. That is correct.

RDQ. 595. As a skilled engineer do you have as a rule any difficulties in quickly grasping the proper ordinary showing of a blueprint or drawing such as "De-

fendant's Exhibit Berry Blueprint No. 1," in order to get a concept of the same upon which you can predicate hypotheses as to operation?

A. Not usually. This is a matter, however, that is largely dependent on the draughtsman, and a drawing of the same apparatus made by one draughtsman would be very much more clearly depicted and easier to understand, and, therefore, quicker to read, than a drawing of the same ^{sketch} apparatus made by ^{some other} ~~one draughtsman~~ would draughtsman.

RDQ. 596. Have you ever had the opportunity to observe the operation of hydro-electric plants upon a synchronous system, and the methods of governing such plants?

A. Yes; if by your question I understand it to refer to circuits supplied by alternating generators, and which feed synchronous motors, rotary converters and like synchronous apparatus.

RDQ. 597. How is it customary to govern such systems with respect to several contributory plants or central stations?

A. In case of plants driven by water wheels, it is usual to have each unit controlled by an independent governor responsive to changes in speed of the unit, due to change in load.

RDQ. 598. Suppose these plants are driven or operated by sources of water supply which vary, so that at one time one plant may have an over plus of water and another plant an under amount, and, vice versa, at which of these plants upon such synchronous system, if any, is governing more practicable?

A. It depends somewhat upon the design of the plants. It is better always to have the maximum possible load taken by those units which are connected with water wheels that have the largest supply of water, and as small a proportion of the load as possible on those plants in which there is a shortage of water.

RDQ. 599. Do I understand by that that it has been your observation that sometimes governing is done for the system at one plant and sometimes at another?

A. In certain types of plants that I know of the governing may be principally done by one of the plants, the others giving all of the power that they are able to give and running continuously at maximum output.

RDQ. 600. Do you know whether Mr. Messimer, the patent attorney referred to, ever wrote to the Pelton Water Wheel Company of San Francisco that it had infringed the patent in suit?

A. I do not, but I believe him to have done so.

RDQ. 601. And this would be in addition to the personal notice which you gave the Pelton Water Wheel Company, or the two notices which you have testified about?

A. If any such communication had ever been sent it would be additional to these.

RDQ. 602. Now, referring to "Complainant's Exhibit A," the patent in suit, will you please state in what manner the rope actuating the by-pass valve is applied to the sheave wheel "54", as shown in Figs. 1 and 5?

A. The rope was meant to pass around a drum or sheave wheel, and in the preferred construction the ends of the rope passed into the periphery of the wheel and

were knotted inside of the periphery so that the rope would be constrained to move with motion of the wheel.

RDQ. 603. Now, in order to shift the by-pass valve from one position to another in the by-pass pipe without rotating the sheave wheel "54" and, therefore, to set the by-pass valve at a different angle, or, call it the normal position, what would you do with respect to this rope and sheave wheel?

A. Simply lengthen out one and draw in the other of the ropes shown in the drawing Figs. 3 and 4, or if the construction were a rope passing around the sheave wheel and depending for its motion on the grip within the sheave wheel, the ropes could be slackened and the adjustment made and the tension again applied to the ropes. There are several methods that might be employed. Those two would probably be the most obvious.

RDQ. 604. And if the sheave wheel were then not turned during this readjustment of the rope the pin "73" upon the sheave wheel would still maintain its normal position with relation to the circuit breaker "74" which is designed to open the circuit through electro-magnet "64"? Is that correct?

A. Yes.

RDQ. 605. And, therefore, with the by-pass valve in its new or changed normal position, the actuating parts and other parts controlling the by-pass, their energization and operation, would not be affected as among themselves as to position or otherwise in any respect, would they, and would serve to actuate and control the by-pass valve in its new normal position the same as previous to such adjustment? Is that, or not, correct?

A. That is correct.

RDQ. 606. I notice in Fig 5 what appears to be some mode of connection of the turnbuckle device with the rope or cable "51" or "52", as the case may be. What will that connection permit as to the turnbuckle?

A. The connection indicated there is a sleeve through which the rope passes, and held in position by a clamp held by a set-screw. I do not understand what is meant by the question "What will this connection permit?"

RDQ. 607. What is the relation between this clamp and the turnbuckle?

A. The clamp is at the end of the turnbuckle. It is a portion of the stud of the turnbuckle which is threaded.

RDQ. 608. And is that stud capable of adjustment with respect to the other portions of the turnbuckle?

A. Certainly. By turning the turnbuckle it changes the position of the stud.

RDQ. 609. And how with respect to the normal position of the stud with respect to other portions of the turnbuckle? Can in any way the play of the central member of the turnbuckle upon or in connection with this threaded portion be varied?

Mr. Westall: Objected to as leading and an attempt to coach the witness.

A. If by that I understand that the stud can be screwed in and out of the turnbuckle so that the distance from one rope connection at one end of the turnbuckle to the other rope connection at the other end of the turnbuckle is changed, this is unquestionably true as it is the function of the turnbuckle to perform just such service,

whether joining together ends of ropes, iron bars or other connecting members.

RDQ. 610. By Mr. Blakeslee : Now, then, put it this way: Is it possible by means of this clamp to lengthen or shorten the reach of rope between it and the cross-lever "50" that carries the stem of the by-pass valve so as to affect the normal position of the by-pass valve subject to further regulation by means of the turnbuckle?

A. Yes. Certainly. That could easily be done. Also, the stem of the by-pass valve could be loosened by loosening the set-screw in the lever, and the valve rotated to any changed position it desired. There are, of course, obvious and numerous methods by which this change in the normal position of a valve can be accomplished.

RDQ. 611. Then taking these disclosures which we have enumerated as to flexibility and adjustability pertinent to and within the train of parts serving to control and actuate the by-pass valve, could you, as an engineer, design from such disclosures a by-pass and its control, fully equipped with respect to adjustability to permit variation of the normal position of the by-pass valve so as to set it at any point between fully closed and half open?

A. It seems to me that any engineer could make ample and sufficient designs from these disclosures. Of course, it is to be understood that my state of mind could not be other than that this would be a full and ample guide to any person skilled in the art.

Mr. Westall: We move that the latter part of the answer referring to the "state of mind" of the witness be stricken out as not responsive to the question.

RDQ. 612. By Mr. Blakeslee: If you were instructed in accordance with the teachings of the patent in suit to design the water-wheel governor, in which means were provided for operating water gate in either direction, and you were instructed also to design a by-pass valve for the water wheel, so inter-related with the means for operating the water gate,—this in either direction—that the by-pass valve would be capable of performing a movement inverse to that of the water gate, within what limits of control of the by-pass valve and relation of it in the movement to that of the water gate would you lay out your designs?

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A. It would depend. If I were making a design for a water-wheel governor for some specific plant in which all the known conditions were before me, I would design a governor and a by-pass valve and the operation of the latter to accord with these conditions. If the length of penstock were very great, I would make a by-pass valve larger than if the penstock were short. If the inclination of the penstock were comparatively slight and ample water were available, I would design the valve to stand normally in its half-open and half-closed position, and be operated inversely to the main gate when the main gate was moved either to its closed or to its open position. If the conditions existed of rapid slope of penstock, or a vertical penstock were present, I would design the main by-pass gate so that it would stand normally in its closed position and operate inversely to the main gate only when the main gate tended to close. Obviously, the relative arrangement of parts and their

relative sizes would depend on the local conditions. If I were manufacturing water-wheel governors in quantities to be shipped to various parts of the world and installed at the various localities to which they were sent, and without a specific design for each specific condition, I would make the by-pass gate to operate inversely to the main gate whether the main gate moved to close or to open, and I would arrange so that the normal position of the by-pass valve could be half-open and half-closed with, of course, the ordinary adjusting means such as have before been pointed out for changing this normal position to some other normal position such as fully closed, and adjusted to operate inversely to the main gate only when the movement of the main gate was to close, so that the erectors of the apparatus at any point could adjust the mechanism to suit whatever specific condition would be encountered. In other words, a universal mechanism would require that the by-pass valve could have its normal position adjusted to any point between fully open and fully closed, that might appear desirable and necessary for the specific conditions under which the apparatus would work.

RDQ. 613. And with the water-wheel gate, of course, mounted so that it could move in either direction to correct or alter the water-wheel speed, would or would not your invention as conceived, develop and disclosed to your patent attorneys for the purpose of application by you for a patent be satisfied and utilized if the by-pass valve were disposed normally in such position that it could accompany movement of the water-wheel gate in an inverse relation and so accompany the water-wheel

gate in only one direction of its direction of movement.

Mr. Westall: Objected to as incompetent, irrelevant and immaterial, and on the ground that the conception or intention or disclosure by the witness to any patent attorneys is not the subject of suit, nor in any way involved in this proceeding except in so far as it may have been covered by the claims in suit.

A. I consider that the construction shown and claimed in the patent covers the movement of the by-pass valve inversely to the main gate, even if it accompanies the movement of the main gate in one direction only and not in the other; and I did discuss this factor or possible condition with the patent attorneys who prepared the patent specification and claims. It, however, is impossible to arrange the by-pass valve in practice such that at some time in its operation it will not move inversely to the main gate in either of the directions of motion of the main gate, even if its normal position be set at the closed position. This can possibly be explained by the assumption of a sudden diminution in load accompanied by a closing of the water-wheel gates, and a corresponding opening of the by-pass valve, which by-pass valve has started from its normal position of being fully closed. By the conditions of the patent the by-pass valve slowly returns to its normal position, while one of the objects to be achieved is that the water-wheel gates shall be moved quickly to their new positions corresponding to the change in load and actuated by the change in speed. Subsequent to movement of the water-wheel gates to the new position of diminished gate opening, and while the by-pass valve is still in its opened po-

sition and starting to return automatically to its normal position of fully closed, if a sudden increase of load be demanded of the water wheels the water-wheel gates will move quickly to a more open position and will cause the movement of the by-pass valve from its then open position to a closed position, which movement will be rapid and in accordance with the movement of the water-wheel gates and not slowly as though the valve were returning automatically to its normal position independent of the action of the water-wheel-gate shaft. And for these reasons I do not consider that under all conditions of load, it would be possible to prevent the by-pass valve from being moved in a direction inverse to the direction of motion of the water-wheel gates, no matter in which direction the water-wheel gates might move, and even if the by-pass valve be adjusted so that its normal position would be completely closed.

RDQ. 614. By Mr. Blakeslee: And this movement of the by-pass valve in a closing direction during this secondary governing, or sub-governing action, would be a positive movement independent of its returning tendency, would it, or would it not?

A. It would be a positive movement independent of its returning tendency.

RDQ. 615. How often in ordinary governing of an ordinary hydro-electric plant is it safe to say, from your experience and observation, that such a combination or merging of governing actions producing such by-pass activities occurs in a day's run of the plant, including both peak and valley loads on the plant?

A. That would depend entirely on the relation of the

fluctuating load to the total capacity of the plant. It in most cases could not be expected except at very rare intervals. But in the case of a very small plant supplying energy to a motor, the size of which was large as compared with the capacity of the plant, and which motor would drive a rapidly fluctuating load, such a rapid succession of load changes as I have described might occur at fairly frequent intervals.

RDQ. 616. In a governor organized such as that disclosed in "Complainant's Exhibit A," the patent in suit, or any governor containing or ^{incorporating} employing the principles of operation and co-action of parts and features disclosed in the patent in suit, is it or is it not possible for any governing effect to be produced upon the water-wheel gate without an impulse being imparted to the by-pass valve, irrespective of its normal or then position, tending to move it in one direction or the other?

A. It is possible and, in fact, contemplated that the water-wheel gates may be moved at times without imparting an impulse to the by-pass valve when the conditions under which the governor is installed make it desirable to so adjust the mechanism.

RDQ. 617. Very well. Then let us assume the same conditions as last mentioned and add the following conditions, namely, that just previously to such impulse being imparted to the water-wheel gates the by-pass valve is connected up with the governor so as to be subject to governing action. Under these conditions is it or is it not possible for any governing action to affect the water-wheel gates without a governing action impulse being imparted to the by-pass valve, in whatever position it

may be, tending to move it in one direction or the other? If you can answer this question by yes or no, please do so. If not, you may make such answer as you best can.

A. The question is not sufficiently clear to me for me to be able to answer yes or no. With the by-pass valve forming a portion of the mechanism as disclosed in this patent and arranged to be operatively connected with the governor, the governor will operate it and move it in either direction whenever operation of the governor takes place and the valve is not in one of its extreme positions of the direction of motion in that direction which would tend to move the valve past this extreme position.

RDQ. 618. And even if the by-pass valve is in such extreme position, we will say either in entirely closed or in entirely open position, and is so connected up with the governor mechanism as to be responsive to governing action, will or will not an impulse urging the by-pass valve to move be imparted to it simultaneously with the passing of the impulse to the water gates to move?

A. If the direction of motion be to open the by-pass valve, it will move; if the direction of motion be to attempt to still further close the by-pass valve, it will not. There may be, of course, an initial effort of the governor to move the valve past its fully closed position, but the prevention of continuance of such effort is disclosed in the patent and need not here be described.

RDQ. 619. But, nevertheless, is it true or is it not true that with the by-pass valve tied in with the governor or hooked up or connected with it operatively, an impulse will be imparted to it urging it to move, whether it can or cannot, in a direction inverse to that of the

water-wheel gate whenever an impulse is imparted to the water-wheel gate?

Mr. Westall: Objected to as having been already fully answered by the witness as far as the witness is able and being merely a duplication of previous questions, needlessly expanding the record.

A. If the gate be fully closed and it be connected operatively with the water-wheel governor and the movement be in such a direction as would tend to urge the gate still further in the direction of closure, there will be a force of pressure tending to move it past the closed position, which pressure will continue until the means of relieving such pressure as disclosed in the patent, have operated.

RDQ. 620. By Mr. Blakeslee: But my question was not with respect to the gate, but the by-pass valve. You have used the term "gate" in your answer.

A. I have in every case meant by-pass valve in the same sense that I have hitherto used it in this testimony.

RDQ. 621. Is it or is it not optionally responsive to the particular determination or selection with respect to the conditions to be dealt with in governing, how far the by-pass valve shall move with and inversely to the water-wheel gate before the by-pass valve comes to its seat, or whether the by-pass valve moves with the water-wheel gate at all inversely thereto in one direction of gate movement?

Mr. Westall: Objected to as leading and suggestive.

A. The functions which you mention are optional so far as the actual movement of the water of the by-pass valve is concerned. As I have previously stated, how-

ever, if the by-pass valve has reached its extreme limit of motion in either direction, and there be a further tendency of the water-gate mechanism to constrain it to move further in this same direction, there will be a force set up tending to move it, but, by the conditions of ordinary design, it cannot be further moved.

RDQ. 622. By Mr. Blakeslee: Is there or is there not in your mind any doubt as to the operativeness of the entire governor apparatus disclosed in "Complainant's Exhibit A," the patent in suit?

Mr. Westall: Objected to as calling for a conclusion on the part of the witness and not for facts upon which a conclusion might properly be based, and as not relating to any specific construction.

A. There is no doubt in my mind but that the construction in strict accord with the disclosure of the patent in suit would be an operative speed-controlling device for water wheels.

RDQ. 623. By Mr. Blakeslee: Is there or is there not in your mind any doubt as to whether such apparatus would constitute a feasible, practicable, serviceable and reliable working device?

Mr. Westall: The same objection.

A. Assuming proper machine design, selection of materials and adjustment, it would possess all these characteristics.

RDQ. 624. By Mr. Blakeslee: You have testified that to make one such governor apparatus would cost approximately \$1600, and that they might be duplicated in manufacture in lots at approximately \$300 apiece. Are you able to tell us what the market price today of the

Lombard governor, such as we have discussed in your testimony, manufactured by the Lombard Governor Company, of Ashland, Massachusetts, is, with the same working capacity as that which you testified about at the manufacture cost of \$300?

A. Approximately from \$600 to \$800 each. I do not mean by this that these sums represent the cost to the Lombard Governor Company, but they represent approximately the market prices at which the governors are sold.

RDQ. 625. As an engineer, if you could find such a manufactured Lyndon water-wheel governor in stock, and purchase price was no consideration, which governor, that Lyndon governor or the Lombard governor, would you select or specify to be installed in a hydro-electric plant the erection of which you were in charge of or responsible for?

A. I would select the electro-mechanical or Lyndon governor provided it were on the market, manufactured by a company of whose continuance of existence I could be assured, so that any time repair parts might be available. I may say here that this matter of ability to obtain repair parts is one of the most important considerations in the selection of any engineering apparatus.

RDQ. 626. And would apply equally in any decision to select and install a Lombard governor?

A. It would apply equally in regard to the Lombard governor or any other governor.

RDQ. 627. You have referred in your testimony to the partially completed Lyndon governor manufactured at Kutztown, and have spoken of it as an experimental

governor. In what respects did you wish us to understand that the contemplated completion of this Lyndon governor was experimental in nature?

A. Only in relative dimensions of mechanical parts. For instance, without a trial, we could not be sure that the electro-magnets would exert a sufficiently great pull to insure engagement of clutches under all conditions, or, on the other hand, we might find that the strength of the pull of the magnets was so great that there had been a waste of material, copper, iron and labor, in making these magnets so large, and that they might reasonably be reduced in size and still give just as satisfactory governing. We might find that the size of the mercury cups instead of being as large as designed could be diminished, thereby decreasing the quantity of mercury necessary. By "experimental," therefore, I mean that from this governor and its operation we could determine the most economical commercial device to be subsequently manufactured and fulfill the conditions as set forth in the patent specification. I did not mean to convey the idea that this governor would be experimental in the sense that I intended to use it in hunting out any new features of water-wheel governing.

RDQ. 628. In adjusting the contact devices of "Complainant's Exhibit A," the patent in suit, namely those which control the energization of the electro-magnets "15" and "16", those which control the energization of electro-magnet "32", and those which control the energization of the electro-magnet "64" the first group of magnets controlling the clutch-gear mechanism, the second magnet controlling the returning device, and the

third magnet controlling the by-pass device, as, for instance, by varying the depth of the mercury in the mercury cups comprising such contact devices, as more particularly disclosed in Fig. 5 of the patent in suit, please state briefly the reasons, based upon more particularly causing the governor mechanism to respond and varying conditions of governor service, which would actuate you to so adjust these contact devices as to vary the sequence of energization of the respective electro-magnets?

A. The depth of mercury or the length of the contact points on the main lever "26", that is to say, the contact "40, 40a", "41, 41a" would be adjusted so that contact could be made to energize one or the other of the main magnets with approximately the same angle or displacement of the lever "26" from its normal horizontal position. Referring to blueprint "Complainant's Exhibit BB" which is here used because it so clearly shows the conditions and assist in the explanation, it is apparent that the contacts "41, 41a" have closed, energization of one of the main magnets has taken place, motion of the water-wheel governor has begun, and all of this has happened before any of the contacts on lever "43", which contacts close the circuit through the magnet actuating the returning device and that one actuating the by-pass valve, have been energized. Therefore, for this particular position of the contacts the governor is moving and moving without either the returning device or the by-pass valve having started motion. This is the condition which exists with a proper setting of the contact points when motion of the speed-control device

first begins. That is, this is one of the transition points in the movement. As the levers keep moving, the next contacts which are closed are those which pass current to the magnet "32" which actuates the returning device. That is to say, by the time the speed-control mechanism has reached this point in displacement, the returning device begins to act. Further displacement of the parts then closes the remaining contacts, which sends current through the magnet "64" actuating the by-pass valve as has before been described. It is obvious that for a comparatively small speed change, and, therefore, a comparatively small movement of the controlling mechanism, that the by-pass valve may not be moved. This would occur for practically infinitesimal speed changes which would be, possibly, subsequent to governor action. On the return of the controlling mechanism to its normal position, the order of opening the contacts would be inverse to that of closing them, namely, the contacts first opened would be those which energize the magnet operating the by-pass valve, the next would be those operating the speed-returning device, and the last magnets opened would be those energizing the main clutch of the governor.

Mr. Blakeslee: That is all.

RECROSS EXAMINATION.

By Mr. Westall:

RXQ. 629. You have stated in answer to a question concerning the device of the Lyndon patent in suit, that assuming proper adjustment, the device would be a practical working device. I wish to ask you whether this

assumption of adjustment included an adjusting means by which the by-pass valve could be placed in normal closed position instead of normal half-open position?

Mr. Blakeslee: Objected to in so far as it does not correctly summarize the testimony referred to, and as calling for a conclusion upon the very statement of the question, and not the proper method of proof.

A. I had not this particular adjustment in mind, for the reason that the machine would be operable whether the by-pass valve were adjusted in the position of half-open and half-closed or in the fully closed position. What I had in mind was with reference to the proper machining of the gears, that the relation of the air-gap of the magnets be properly adjusted so that the magnetic pull might be fully exercised, and that the adjustment at the end of the lever "14" might be such that when one end thereof was pulled close up to one of the actuating magnets the clutch on the other end would have been thrown into operative position. Also, the same statement applies to the idea that the distance of separation of the end of the magnet "32" from the cooperating end of the lever "31" should be such that when the end "31" has moved to its extreme position toward the end of the magnet, it would at the same time have brought the two discs "22" and "23" of the returning device into frictional contact. Furthermore, that by adjustment of the nuts "36b,36b" thereby adjusting the tension of the springs "37,38" that the solenoid core "34" would be properly balanced. I meant adjustments of this kind. The parts of any machine might be thoroughly well made and assembled, but without adjusting the relation of

these parts properly no machine will be a satisfactory operating device.

RXQ. 630. By Mr. Westall: And you also meant to include within such proper adjustment the height of the mercury in the cups, as illustrated in "Complainant's Exhibits AA, BB and CC," which are not disclosed or shown or hinted at in the patent in suit, did you not?

Mr. Blakeslee: Objected to as placing an apparently improper construction upon the patent in suit, in which these mercury cups have been found by the witness several times and discussed by him.

A. I, of course, contemplated a proper adjustment of the contacts so that on movement of the controlling mechanism the contacts would be made at proper points and proper times with reference to the movement of the lever.

RXQ. 631. By Mr. Westall: Have you any means of knowing or do you know the manufacturing cost of the Lombard Governor to which you have referred on your redirect examination?

A. I have no means of knowing what the Lombard Governor Company's cost for manufacturing, including their overhead charges, are.

RXQ. 632. From your general engineering experience and from your knowledge and long study of the device of the patent in suit, could you in any way compare the cost of manufacture of the device of the patent in suit with the cost of manufacture of the Lombard governor? That is, assuming, of course, a plant should be installed and equipped with such completeness and with such capital as the Lombard Governor Company's plant

for the manufacturing of the device of the Lyndon patent in suit?

A. I have not made any such comparison that I recall that is of definite character. The construction of the Lombard governor being such that it has always appeared to me as obvious that it would cost more to manufacture than the governor disclosed by the patent in suit, assuming the conditions surrounding both which you mention, I could make a fairly close estimate of the actual cost of the Lombard governor, but this would, of course require going over the details and estimating the cost of each separate portion, and taking these together and to this adding the cost of assembling and such additional shop charges as testing, packing and preparation for shipment. But, as I have not done this within recent years, and I do not now remember about any previous estimates of this kind of a definite character, I could not give you a comparison that would be of any value. I judge, however, that the so-called Lyndon governors could be made at a cost of not exceeding from 60 to 65 per cent of the cost of a corresponding Lombard governor, this referring, of course, to shop costs only, for labor and material, and exclusive of overhead charges. Furthermore, my estimate of about \$300 to \$325 as the cost of a Lyndon governor, was an outside figure and did not contemplate as favorable conditions of manufacture as you mention, and also included it in some of the ancillary charges.

RXQ. 633. Including all of the shop costs and roughly approximating or estimating the relative cost of the two devices, would you be willing to say that the Lyndon

device could be made at 60 or 65 per cent to be placed on the market and sold at a profit of 60 or 65 per cent of the cost of the Lombard governor?

A. These also would depend on the quantities of any specific size which might be made. But, taking as an example a 5000 foot-pound governor, I believe that the shop cost of the Lyndon governor would not exceed \$195 or possibly \$200, and that the shop cost of the Lombard governor of the same capacity would run somewhere between \$275 and \$300.

Mr. Westall: That is all.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 634. Is it possible to set up and make ready for use and operation any other water-wheel governor, or any other hydro-electric apparatus with which you are acquainted, without first adjusting or tuning up parts so that they shall be in their best condition and most harmonious relation for service?

A. No.

March 12, 1915, A. M.

GEORGE J. HENRY, JR., complainant herein, being recalled on his own behalf, the direct examination is resumed.

By Mr. Blakeslee:

RDQ. 532. What does the presence of the indicator device at the Power Development Company plant, or Power, Transit & Light Company plant you have pre-

viously referred to, and the observation of the same in connection with the handling of that plant, indicate?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial, not proper rebuttal. The condition of the plant, or any of its equipment at the present time, approximately seventeen or eighteen years after the time that the device set up as a defense in the answer was installed, cannot possibly in any manner affect any of the issues within the present proceeding.

Mr. Blakeslee: Without argument, we will merely reply that we are attempting to show the conditions not only existent at that plant at the present time, but likewise existent at the period of its attempted operation, of the alleged anticipatory nature. Furthermore, we are attempting to show the failure of that plant to do and continue to do what it has been attempted to be proved it was designed and installed to do.

A. It indicates the variation in the depth of water in the forebay, and, therefore, the head of water operating against the wheels. The indicator device is mounted at the box or tank called in the art "the forebay," from which the pipe receives its water, and the position of the surface of this water determines the actual head operating against the wheels. The head of this surface is indicated by a float and a weight of the usual type, and is observed through a telescope from the power house. Such observations are made frequently by the operator in charge to enable him to intelligently make the necessary adjustments of the hand-controlling devices to use most effectively the water under its varying head. This

variation in head is one of the variables to be met with in power house operation.

RDQ. 533. By Mr. Blakeslee: Is such variable head a factor usually met with and to be dealt with in power house practice?

A. Very frequently is it met with.

RDQ. 534. From your knowledge of power supplying stream conditions, particularly in California, can you state with certainty as to whether any given stream, the energy of which is used for hydro-electric power generation, maintains its general flow conditions and changing head conditions perennially unless these are altered in some artificial manner?

A. No; nearly all streams vary greater or less amounts during different months of the year, during different days of the month, and during different hours of the day.

RDQ. 535. And is that true of any given stream year after year, so that the general average of fluctuation of flow for a given year is substantially the same as for a previous or subsequent year?

A. Over a long period of time it will average about the same.

RDQ. 536. What causes these fluctuations?

A. Fluctuations are occasioned by numerous causes. For example, a stream that is fed from snow fields close to the point where the measurements are made, will flow very much more on a bright sunny day. A stream that flows through a long water-shed, denuded of vegetation, will have its heaviest flow immediately following a rain storm; hot sunny days will tend to slightly reduce its

flow. There are so many factors that enter into the determination of the final flow passing any given point in a stream, that it is difficult to give any brief account of the degree of these effects. I might say that the degree of variation from normal flow is many hundred per cent in some streams, and comparatively few per cent in others. There are, however, in all streams frequent variations which make it advisable where the greatest economy is to be accomplished by the hydraulic station that these variations be taken into account not only in the original design and application of the apparatus, but in its operation as well.

RDQ. 537. And for those reasons, and particularly dealing with the conditions pertinent to the head variation indication at the Power, Transit & Light Company plant, can it be stated with reasonable certainty as to the occurrences of these variations in head at that plant at the time there was attempted to be operated the purported water-wheel governor, including the speed and load-sensitive device installed with the Girard water wheels?

A. There could never have been a time within the memory of man when there would not have been fluctuations in the flow of the Kern River. Such fluctuations would reflect in the depth of the water flowing in the flume, tunnel or canal supplying the pipe line to this power plant, even though only a fraction of the water of the river were in use by that plant. The point of intake of the pipe line is something that was fixed by the slope of the flume as indicated in the upper right-hand corner of "Complainant's Exhibit Power Development Company's plant," and regardless of any flume changes

that might be made, or of the substitution of a flume for a tunnel, there would still be reflected at the intake of the pipe line the changes in water level which would occasion the changes in head on the water wheels. These changes would occur even though regulation were also affected at the intake of the flume, as it probably is and was. The artificial changes in the water flow in the flume or tunnel at its intake and at the opposite end from the forebay and pipe intake, would also occasion these changes in head, and there is no doubt in my mind but that this plant must have had such changes at the time of its original installation, as did and as do most other power plants of a similar nature.

RDQ. 538. Referring now to "Defendant's Exhibit Berry Blueprint No. 1", "Defendant's Exhibit XX," and "Defendant's Exhibit MZ," and "Defendant's Exhibit Cobb Blueprint No. 1," have you examined these exhibits and familiarized yourself with their disclosures and come to any conclusions as to the intended construction and mode of operation of the device disclosed in them?

A. I have.

RDQ. 539. I call your particular attention to the parts in "Defendant's Exhibit Berry Blueprint No. 1" shown in detail in Fig. 1, and to the parts and features shown in "Defendant's Exhibit MZ," and ask you to state briefly what you understand to be the intended construction and mode of operation reflected by these exhibits?

A. These exhibits to which you have directed my attention indicate a dynamometer for measuring the load

between two rotating shafts, and the degree of movement of the weighted levers within the fly-wheel when properly adjusted indicate the amount of load being transmitted from one shaft to the other.

RDQ. 540. With what part or parts of the hydro-electric installation do you understand the annulus or wheel "M" and the yoke or diamond shaped piece "B" of "Defendant's Exhibit MZ" are respectively connected?

A. The fly-wheel "M" carrying the pivots "H", "H' ", I understand from "Berry Blueprint No. 1" to be mounted upon the shaft driven by the water wheels, and from "Defendant's Exhibit Interior of Power Development Company Plant," I understand this shaft to be the generator shaft. The link "B" in "Exhibit MZ" I understand to be mounted upon the water-wheel shaft. This is the driving shaft, and the link "B" therefore pulls the link "~~BB~~-B" around, dragging after them the wheel "M" in the direction of the arrow on "Exhibit MZ."

RDQ. 541. Through what agencies is the wheel "M" so dragged around by the water-wheel shaft?

A. Through the links "DD' " and the levers "EE", connected with the wheel "M" at the point "HH' "

RDQ. 542. And these levers are pivoted into the annulus?

A. They are.

RDQ. 543. And, therefore, capable of moving in the annulus, and, if that is the case, what takes place during the rotation of the annulus and the production of centrifugal action in the levers?

A. When the device is rotated from the water-wheel shaft at sufficient speed, depending upon the adjustment of the weights "F", "F' ", and the springs "SS' ", and the load being transmitted from the wheel to the generator, they will move under the action of centrifugal force, causing a torsion or displacement between the generator shaft and the water-wheel shaft. The position of these levers will then be varied upon a change of load transmitted between the two shafts, regardless of the cause of such change of load. The device is itself a load-measuring or load-indicating device.

RDQ. 544. How is such measurement or indication rendered appreciable?

A. By the relative torsional displacement between the shaft carrying link "B" and the shaft carrying the wheel "M".

RDQ. 545. And that produces what visible effect with respect to the levers?

A. That causes a variation in the position of the levers "EE" with respect to their distance from the center of the shaft.

RDQ. 546. And this advertises the change of load. Is that correct?

A. Yes.

RDQ. 547. And what constrains the levers so that they respond in change of position to this variation of load?

A. As I have before stated, the indication of change of load will, of course, only occur when the device is properly adjusted. Such adjustment depends on the

weights "FF1", springs "SS1", the load being carried, and the rotative speed of the parts.

RDQ. 548. As the annulus "M" moves, will the levers maintain the same positions with differences of speed of rotation of such annulus, or what will be the effect?

A. They may or may not, but they will be disturbed from their positions upon a change of load. All my testimony in regard to this device is based upon the mechanism being properly adjusted with respect to the moments entering into the determination of the loads being carried between the two shafts.

RDQ. 549. What movement will an increase of load tend to produce in the levers?

A. If a greater load comes upon the electric generator this demands of the water-wheels that they supply the additional energy. The result is that a drag is put upon the wheel "M" in the direction opposite to the arrow on "Defendant's Exhibit MZ." Such a drag or retardation will result in drawing inward the levers "EE1". It must be noted that in this exhibit these levers are shown against their stops. The normal position of the lever "E" will be at a point substantially midway between the position shown in full line and the position "FM", but it will be drawn in on the increase of load on the generator toward the full line position "E".

RDQ. 550. What will maintain the lever in this stated normal position?

A. A constant transmission of energy or load from the water-wheel shaft to the generator shaft will maintain it in a fixed position, which fixed position will be proportional to the actual energy transmitted or degree

of load. Upon an increase of load the levers will move inward. Upon a decrease of load it will move outward, in the former case increasing the tortional displacement between the water-wheel and generator shafts, and in the latter case decreasing it.

RDQ. 551. And this position of the levers outward from their stops during joint rotation of the water-wheel shaft and the generator shaft takes into consideration, does it, also, the centrifugal force tending to throw these levers outwardly towards the dotted position you have mentioned?

A. It does. The position occupied by these levers, as I have before stated, is dependent upon the load. The load is counterbalanced by the speed, centrifugal force acting upon the weights and levers, and the springs. As the device rotates faster the centrifugal force acting is greater. As it rotates slower the centrifugal force acting is less. The result of the action will be that if the load on the generator, and, therefore, on the dragging effect of this load on the wheel "M" be increased, the weights and levers "EE1" will move inward towards the shaft toward their full line position in "Exhibit MZ" to some new position, and the result will be fall of speed or a retardation in the rate of movement of the shafts. And this new position will be a position of equilibrium of the rotating weights, levers and springs at the new load.

RDQ. 552. Then as I understand you, the speed factor tends to throw these levers outwardly and the load factor tends to the opposite movement, or to move them toward their seats. Is that correct?

A. Yes.

RDQ. 553. Now, with these two forces acting upon these levers and the levers off their seats, the power of the water wheel is being transmitted to the generator through these removable unfixed lever elements. Is that correct?

A. Yes.

RDQ. 554. Now, with the levers in such instance or, as you term them, normal positions, with the power of the water-wheel shaft being transmitted to the generator shaft through these unfixed levers, assume that an increase in load occurs on the generator and an increase of head occurs in the pipe line supplying the water wheel. What will be the result with respect to the then positions of said levers, and why?

A. If this came about slowly, as it probably would in practice, due to an increasing depth of water in the forebay, as previously testified to, the levers would undoubtedly remain fixed in their position and neither apparatus would increase in speed, causing an over-voltage on the circuit; and if this were of a sufficient degree it would cause, probably, the burning out of incandescent lights and fuses.

RDQ. 555. And would such action of this device under discussion be or have been possible at the Power Development Company plant, with the changes in head there occurring, judged from the use of an indicator device at the forebay?

A. Such conditions would be inevitable with this device if used at that plant or any other. The indicating devices you have mentioned would confirm the belief that such actual experiences were encountered at this plant.

RDQ. 556. And assume that it was attempted to govern the water wheels of that plant by means of this load-weighting device we are discussing, independently of any hand controls, what would you say under the conditions pertinent to the changing head of water at that plant as to the results flowing from such increase in head and increase in load?

A. I would say that with this device disturbances in the speed would of necessity occur. By regulation of the plant I assume you mean the regulation by automatic control of the speed to maintain the speed or rate of rotation constant. This is absolutely essential in power plants, and all modern electric apparatus must, to successfully operate, be supplied with current at the proper electro-motive force, and this presupposes a maintenance of the proper speed on the electric generator, and the water wheels must therefore rotate the electric generator at a constant speed regardless of the load output. Any governing of the water wheel must, therefore, depend primarily for its sensitiveness upon any alteration of speed, or, at least, must correct any alteration of speed regardless of load. The device to which you have directed my attention and as shown in "Berry Blueprint No. 1," and "Defendant's Exhibit MZ," is a load-governor, or dynamometer, and is sensitive to load only. The load as weighed or indicated by the position of the weights and levers in this dynamometer is made up of the rotative speed resulting in a certain definite centrifugal force, and, in addition to this, the springs and the pull between the two shafts through the links "DD¹" is such that the levers "EE¹" may occupy positions intermediate be-

tween their full inward and outward positions for different speeds, occupying frequently the same position for two radically different speeds, it only being necessary that the load change without the speed changing in order to move them. Or, to put it in other words, the load being reduced and the speed being simultaneously increased to the corresponding degree, the levers will not move and therefore the governor would not be set into operation. And, vice versa, if the load be ^{reduced} ~~increased~~ and the speed simultaneously reduced, the levers will occupy their same position and no governing movement will occur. We here have the condition where the speed changes which are fatal to electric service without the governor acting to cause a correction or return to the correct speed.

RDQ. 557. Yes. You were right in your assumption that by controlling this plant I meant controlling or attempting to control the speed of the water wheels. Now, when any such attempts as were made at that plant by the use of this dynamometer as you have termed it were made, was it possible for any correction of speed to be made without a change in position of the levers "EE1", and, therefore, a relative movement between the water-wheel shaft and the generator shaft?

A. For any correction to be made of the speed of the water-wheel shaft by a movement of the water-wheel gate, it would be necessary for these levers to first move.

RDQ. 558. And that would result, or would it not, from a disturbance of the coupled relation between the generator shaft and the water-wheel shaft?

A. It would result in a greater or less displacement in

the rotative direction between the two shafts. This would cause material fluctuations in the cycles or alternations of any alternating current electrical apparatus being driven therefrom, which would also be fatal to good electric service.

RDQ. 559. And before there could be any correction of the speed of rotation of the generator shaft there would have to be an increase or decrease of the torque or twisting effect, as between the generator shaft and the water-wheel shaft. Is that correct?

A. That is true.

RDQ. 560. And therefore this dynamometer was not responsive purely to variations of speed of the water-wheel shaft, but to the relative variations of speed of the water-wheel shaft and the generator shaft. Is that correct?

A. That is correct, absolutely; such relative displacement being measured in this dynamometer, of the load.

RDQ. 561. Now, in this "Complainant's Exhibit A," the patent in suit, what is the relation between the sensitive element of the governor and the water-wheel shaft, and by that I mean the sensitive element which sets the other parts of the governor into motion.

A. The element is sensitive to the voltage variations and, therefore, in direct proportion to speed, absolutely regardless of load.

RDQ. 562. Would such a device as this dynamometer in which conflicting effects of change of speed of the water wheel and change of load on the generator might prevent any movement of the dynamometer parts, be a dependable governor for maintaining constant the rate of rotation or speed of the generator shaft?

A. It would not under any conditions if coupled as here shown. If the two shafts were rigidly joined together and the centrifugal effect only of the weights and levers in this device were utilized for the purpose of setting into movement some train of mechanism for shifting the gates, it might under such conditions be used for a centrifugal element sensitive to speed and not load. But this would require the coupling together of the shafts, and the design of the parts to be sensitive to centrifugal force only, and not transmission of any load. This would of course, be an entirely different construction, and would merely become, under such conditions as I have indicated, a centrifugal rotating element.

RDQ. 563. And under those conditions would it be a flexible or yielding coupling between the generator and water-wheel shaft?

A. Absolutely not. There would have to be a rigid connection between these two shafts, or, at least, a connection into one, transmitted through any part of this dynamometer, as indicated in "Defendant's Exhibit MZ".

RDQ. 564. And since this dynamometer is a flexible coupling between the two shafts, is it possible for it to measure and indicate any governing act responsive to changes purely in speed of the generator shaft?

A. It is not.

RDQ. 565. And is or is that not true with respect to the speed-sensitive governing element of "Complainant's Exhibit A," the patent in suit, namely, the dynamo "8"?

A. It is.

RDQ. 566. When you were last at this Power, Tran-

sit & Light Company plant, at the mouth of the Kern River Canyon, some three weeks ago yesterday, did you observe there any such device as this dynamometer you have told us about?

A. I observed parts of what I believe to have been the device indicated in these "Exhibits MZ" and "Berry Blueprint No. 1" and "Cobb Blueprint No. 1."

RDQ. 567. What, if anything, was the office of these parts then and there observed?

A. The fly-wheel "M" in "Exhibit MZ" was coupled up rigidly with both shafts, or, at least, there were no governing elements for transmitting any speed or load-sensitive movements from such mechanism. There may have been a flexible link or a fibre link or disc between the water-wheel shaft and the generator shaft, but there was no possible means for any rotative displacement between the two shafts, this element having been entirely cut out of it, if it existed. The shafts were to all intents and purposes, as far as any governing could be concerned, rigidly connected together.

RDQ. 568. By means of such a dynamometer, in the attempt to use the same to control or maintain constant the speed of the water-wheel shaft, for counter-acting speed for load changes, or, as you have testified, to produce any movement of the dynamometer parts to institute governing, would such a dynamometer be reliable as a water-wheel speed-controlling device?

A. It could not, under any conditions that I imagine, be satisfactory as a water-wheel speed-controlling device.

RDQ. 569. Could it or could it not perform the func-

tion of a water-wheel governor being the subject of "Complainant's Exhibit A," the patent in suit ?

Mr. Westall: Objected to as calling for a mere conclusion on the part of the witness and not calling for any comparison of structures, or any evidence of fact, or any description of any device contained in either of the devices.

A. It can not.

RDQ. 570. By Mr. Blakeslee: In the governor of "Complainant's Exhibit A," is it, or is it not possible for any change in the speed in the water-wheel shaft to occur without a responsive action of the governor or a tendency of the governor to respond, initiated by the responsive action of the speed-sensitive device named in the dynamometer "8"?

A. It is not.

RDQ. 571. And in the use of the dynamometer of the defendant's exhibits we are discussing, is it not or is it possible for changes in speed of the water wheel to occur without any responsive action of the dynamometer to initiate water-wheel speed regulation in this dynamometer?

A. It is.

RDQ. 572. If such a dynamometer device were used in an attempt to regulate water-wheel speed in a hydro-electric plant, what would result to the electrical energy consumers upon the current supplied by the plant because of such failure of the dynamometer governor element to act at all times responsive to changes in speed of the water wheel or wheels?

A. Fluctuation in voltage, as a result of fluctuations

in speed at the power house, which voltage fluctuations would cause a variation in the speed of motors and a variation in the illumination of incandescent lights. Either or both of these results would be termed very unsatisfactory electric service, occasioning great inconvenience, expense and disaster to the consumers.

RDQ. 573. Have you also examined these exhibits now under discussion, and particularly the blueprints thereof, with respect to the remaining device attempted to be portrayed therein?

A. I have.

RDQ. 574. Now, assuming that the alleged by-pass valve "41" capable of action to by-pass water from the pipe line around the water wheel, and the same were attempted to be operated by the dynamometer of the defendant's exhibits which we have just been discussing, and that this dynamometer were also operatively connected with the water-wheel gates shown in these exhibits, would or would not therein exist the combination with a speed-sensitive governor element of a water-wheel gate and a by-pass valve adapted to operate responsive to the control of the speed-sensitive governor element?

A. No.

RDQ. 575. You have heard the testimony of Messrs. Dearth, Sessions, Beal and W. W. Wilson, given on your behalf, in making these proofs?

A. I have.

RDQ. 576. What, as an engineer, would you deduce from their testimony and your knowledge of the present condition of the Power, Transit & Light Company plant, to have been the true nature of the attempt to operate a

central station by means of the Girard water wheels, or by means of any of the water wheels at that plant at all, so as to control the speed of the same through the dynamometer element we have now under discussion?

Mr. Westall: Objected to as calling for a mere conclusion of the witness and as calling upon the witness for an omnibus interpretation of the testimony of a number of witnesses.

A. That the apparatus was there installed in response to a strongly felt need, but that the design, construction and experimental work in connection with an effort to operate this apparatus, was purely of an experimental nature, the experiments being based upon misconception of the principles involved in this apparatus and the generic requirements to be met.

RDQ. 577. By Mr. Blakeslee: In your engineering practice have you ever known of such a dynamometer device or governor element in which speed factors and load factors might counteract each other to nullify action, to have been successfully employed for the purpose of regulating the speed of water wheels and maintaining constant generator speed.

A. No, sir.

RDQ. 578. How many different types of water-wheel governors, roughly speaking, have appeared and have been attempted to be used since 1897, when we are informed that this dynamometer device was attempted to be operated at the Power Development Company plant?

A. There are about six makers of governors in the United States, each of whom has brought out a number of types of governors since that time.

RDQ. 579. Have any of these governors utilized this dynamometer principle or load-weighing principle or principle of action, including the opposing of the speed factor to the load factor in affecting the position of parts of the governors?

A. I know of no successful governor along these lines.

RDQ. 580. Has the trend of development of water-wheel governors since the year 1897 at any time been toward such dynamometer device types of sensitive gov-
governor elements?

A. Absolutely not. There have been a few erratic excursions from the field of purely speed-sensitive devices, but they have been quickly abandoned.

RDQ. 581. Referring now further to "Defendant's Exhibit Berry Blueprint No. 1," will you please state what, judging by the construction therein portrayed, would be the nature of the responsiveness of the by-pass valve "41" to the action of the various actuating parts intended to move the same to pass water around the water wheel or regulate its passage?

A. Its action could not be other than erratic. unreliable and unsatisfactory.

RDQ. 582. Please state your reasons.

A. On account of, primarily, the type of valve used. The valve shown on this exhibit is a plug-cock type of valve in which the valve surface must rub over its seat in order to vary the valve position, and, therefore, the port or discharge area. This friction element is a very large one, amounting in the exhibit you have shown me to several tons. This large friction even on the slightest movement of the valve, if it be only 1/16 of an inch,

places a load upon the governor which, even with the best possible modern type of governor would destroy its sensitiveness. This plug-cock type of valve indicates a total ignorance or disregard of the primary requisite in governor control valves. It is well known in the art today that a governor valve must be sensitive; that is, it must be capable with the least amount of effort to move from one position to another, commencing its movement quickly and stopping at an accurate predetermined point, determined by the governor speed-sensitive device, and that it must be as nearly balanced as possible and as free from friction as possible. Generically, the types of valve shown in "Berry Blueprint No. 1" and "Cobb Blueprint No. 1" do not meet these requirements as compared with valves of another genus. This I indicated in my testimony previously given in regard to "Wilson's Sketches A to E, Inclusive," in which the types of valves shown in Sketch A and Sketch B generically belong to the type of valve for use as governor-controlled by-passes, and as distinguished from the types of valves shown in "C, D and E." No one skilled in the art today under any conditions attempts to use a valve such as is shown in "Berry Blueprint No. 1" for by-pass control or water-gate control.

RDQ. 583. Judging by the scale of dimension of the parts attempted to be followed in "Berry Blueprint No. 1," please state whether, under the water pressures which must obtain in that plant upon the by-pass valve, judging from your inspection of the plant in its present condition, with its slope of penstock, and judging from the testimony and the exhibits in this case, what re-

sponsiveness could exist with respect to the attempted by-pass valve and the attempted dynamometer device with its lever arms "2-2", assuming that the changes in position of these arms sets in motion the train of parts ultimately acting upon the by-pass valve?

A. It could not be other than erratic, if it responded at all. I would not expect the device shown to be capable of moving the by-pass valve with any degree of certainty. The parts are entirely too light to carry any such load as would be imposed for such by-pass valve. I feel that the design of this by-pass valve indicates a total misconception on the part of the designer to appreciate the device involved, or the attainment of the end absolutely essential to successful adaptation of the by-pass, either to prevent inertia effects or to secure water economy.

RDQ. 584. Is any means provided with respect to this attempted by-pass device under discussion whereby the by-pass device might have been caused to return to a given or normal or customary position subsequent to its movement accompanying movement of the water-wheel gates?

A. No such parts are shown or even possibly indicated, in any of the exhibits disclosing or purporting to disclose the apparatus at the Power Development Company plant.

RDQ. 585. Did you hear the testimony of Messrs. Cobb, Berry and Van Emon and Dearth, which has been taken in this case?

A. I did.

RDQ. 586. Did you hear or read the testimony of any of such witnesses mentioning the provision of any

such arrangement or means for permitting or causing the attempted by-pass valve of this plant at any time to return to a normal or usual position after its movement accompanying water-wheel gate movement?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial. What the witness may have failed to hear cannot possibly affect any issue in the case.

A. Nothing of the kind was testified to as having been built or operated, or in any way involved in this apparatus.

RDQ. 587. By Mr. Blakeslee: What have you to say as to the practical operation of a hydro-electric plant utilizing a by-pass device which was in fixed relation to the water-wheel gates, so that after making the same movement in one direction or the other the by-pass valve could not return to a normal or usual position?

A. Such by-pass operation and adjustment is sometimes required in modern plants for the purpose of maintaining a constant flow of water, but it is rather unusual, as the by-pass is usually adjusted to return to its normal position to effect water economy.

RDQ. 588. What are the essential characteristics of a plug valve with respect to its mounting and accommodation in its case, and movement with respect to its seat?

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A. The substantial characteristics are inoperativeness as the result of the heavy friction element due to the rubbing of the valve upon its seat, as an essential to operation, and as generically distinguished from the types of valves used for successful governor control.

Mr. Blakeslee :

RDQ. 589. Is such a valve so responsive to the water-wheel governor action of any nature as to permit such governor to effectually take care of the conditions requiring governing?

A. They will not operate successfully with any governor to meet the conditions of the governing of water wheels.

RDQ. 590. Referring to "Defendant's Exhibit Berry Blueprint No. 1," what is the indicated relation between the water-wheel gates and the purported by-pass device, and the features intended to actuate the same, and related to the joint action of the same?

A. The intended action as disclosed in "Berry Blueprint No. 1" is that as the water-wheel gate moves in a closing direction, the by-pass valve be opened; and as the water-wheel gate is being moved in an opening direction that the by-pass valve be closed. The connection between the water gate and the by-pass valve are of a rigid nature, requiring invariably a movement of one when the movement of the other occurs, if the device would operate as intended.

RDQ. 591. Now, under these conditions, supposing the attempted by-pass device resisted attempted actuation or obstructed governor action, or interfered with it, what would be the effect upon the governor action in its relation to the water-wheel gate?

A. It would lock the water-wheel gates against movement, preventing the gates from responding to the effort of the governor, or some of the parts would be broken by the resistance of the by-pass valve to such motion.

RDQ. 592. Therefore, short of such breakage as you have mentioned, what would be the effect upon the governing action with respect to the water-wheel gates?

A. Inoperativeness.

RDQ. 593. In the purported disclosure of these two blueprints under discussion, and "Defendant's Exhibit XX," and "Defendant's Exhibit ZZ," and "Defendant's Exhibit MZ," do you or do you not find the combination with a speed-sensitive governor element of a water-wheel gate and a by-pass valve of pre-acting type only in engagement with its seat when closed?

A. I do not.

RDQ. 594. In order to properly come within the definition of "plug cock", what must be at all times the relation between the cock and its seat?

A. It must entirely fill the chamber, fitting its seat.

RDQ. 595. And be in what direct relation to its seat?

A. In contact with its seat at all times. Under the working conditions of hydraulic pressure against such valve, as will always exist in practice, the valve is naturally forced against its seat by such hydraulic pressure.

RDQ. 596. In the use of the governor element disclosed in the exhibits which we have been discussing and which you have referred to as the dynamometer, what have you to say with respect to the forces militating against responsiveness of action of the moving parts as compared with the corresponding action or permission of action or condition of action in a purely speed-sensitive governor element?

A. This dynamometer as indicated in "Berry Blue-

print No. 1'' and "Defendant's Exhibit MZ" is designed with a total disregard to sensitiveness to speed, in that a speed-sensitive device must primarily consist of an element movable with a minimum amount of friction. Any friction that may exist, however slight, retards the sensitive movement of the speed-sensitive element, as such, preventing its movement. That is, such friction is a load preventing its movement. It will therefore be obvious that the greater this load be made the less sensitive will the speed-sensitive element be to slight speed variations. For example, in a fly-ball governor, if the weights or fly-balls be swung upon knife edges, the friction element is very slight and the weights will respond by swinging in a larger circle upon the slightest increase of speed, and, vice versa. In the case of the speed-sensitive element in the Lyndon invention as disclosed in "Complainant's Exhibit A," the patent in suit, the movement of the solenoid will respond very sensitively to speed changes, the friction element being absent in the springs and present to the smallest possible degree in the light moving parts and their pivotal supports which are actuated by the solenoid. If in a fly-ball governor the weights be suspended from large levers with large pivotal points, friction or initial load is introduced to a very damaging degree, preventing the sensitive response by the weights to a speed change. Any load that may be placed upon a speed-sensitive device greater than the minimum necessary to set into operation the governing motive power, militates directly against sensitive speed-control by such a governor, and anyone building a governor in which a load is placed upon the fly-balls other than the minimum, causing the

movement of the other governor elements, would produce exactly the contrary effects from those sought for. In the case of the alleged governor disclosed in "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit MZ," the designer either in ignorance of or with a total disregard of the primary rules laid down above has artificially introduced in this dynamometer a load upon the centrifugal force of the weights, not only reducing, but, in the case before us, so much power or load is transmitted as to absolutely eliminate any possible sensitiveness of this device to speed fluctuation in comparison with what is demanded of a governor in the art. The device would have come nearer accomplishing speed-control had it not been a load governor at all, and the two shafts been rigidly connected together and the weights, arms and springs as shown in Fig. 1 been arranged responsive to speed and not at all to load. This would have given an approximation to a governor and would have indicated to my mind an understanding on the part of the designers of the principles involved. I have heard the testimony in this case, and read it, and I understand therefrom that the designers intended this as a load governor, it having been repeatedly called a "load governor", and a "load-and-speed governor", and "a dynamometer" by Berry, Van Emon and Cobb, and my conclusion from the scientific principles involved in this construction as outlined above, is borne out, therefore, by their testimony, where it is distinctly stated that it is responsive to load and speed, but is a dynamometer. A dynamometer is a load-measuring or indicating device, always. This device is not and never could have been a speed-sensitive device for water-wheel government.

Mr. Westall: Counsel for the defendant objects to the witness arguing the case and moves that the answer be stricken out as not responsive to the question and as argumentative, and not being a statement of facts in any respect properly within the issues of the case.

Mr. Blakeslee: The answer speaks for itself.

RDQ. 597. Do or do not the considerations you have mentioned in discussing this dynamometer enter, in your mind, into the reasons why this Girard water-wheel apparatus, with the attempted by-pass device, was thrown out of the Power Development Company plant and scrapped within a short time after its first attempted operation? And, if so, to what extent, and for what reasons.

Mr. Westall: Objected to as calling for a mere conclusion on the part of the witness without showing upon what those conclusions might be based, and as being argumentative.

A. The principles and results of operation of this device as set forth in my previous answer would cause the absolute inoperativeness, as far as sensitive speed indications for control, if built in accordance with "Defendant's Exhibit MZ," or "Defendant's Exhibit Berry Blueprint No. 1." Therefore, such a device could not have been of any use for the purpose of automatic speed control.

RDQ. 598. By Mr. Blakeslee. If you were informed that the Girard water wheels at this Power Development Company original installation developed an efficiency of more than 80%, what would you have to say, as a hydraulic engineer, as to the efficiency of these wheels as compared with the usual effectiveness of wheels?

A. I would say that the efficiency was particularly good. Eighty per cent all over is a high efficiency for wheels of this size and under this head in the very best water wheels made today, eighteen years after these wheels were built.

RDQ. 599. Would any competent, careful engineer advocate the discarding of water wheels developing such efficiency because of such efficiency factor?

Mr. Westall: Objected to as calling for a matter of opinion, outside of the qualifications of the witness, namely, upon the matter of what a careful, competent engineer might do or might not do under certain conditions, which conditions, as set forth, are not material to this case.

A. Any engineer who might reject tangential water wheels on the sole ground of lack of efficiency when he found the wheels were giving an efficiency of 80% or more, would, in my opinion, be incompetent.

RDQ. 600. By Mr. Blakeslee: In all of your experience as a hydraulic engineer, including your long connection with the Pelton Water Wheel Company, former intervenor in this case, as its chief engineer, did you ever know of a water wheel being rejected on the efficiency factor when it developed an efficiency of over 80%?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial.

A. I never knew of a water wheel being rejected solely on the efficiency factor if the efficiency was 75% or greater.

RDQ. 601. By Mr. Blakeslee: Would the use of the attempted by-pass device as shown in the "Berry Blue-

print No. 1" and these other exhibits before us, and mounted and controlled as therein indicated, be feasible and practicable in a hydro-electric power plant in which saving of water was the important matter, and whatever your answer may be, please give the reasons for it.

A. No; it could not effect a saving of water in that the opening of the discharge of the water from the pipe line is intended to be present, and the assumption by the designer that the by-pass would be operative, in that if the water gates are partially closed it was his intention that the by-pass valve should be partially open, so as to maintain substantially a continuing flow of such water through the by-pass as had been rejected by the water wheel.

RDQ. 602. Referring now to "Defendant's Exhibit XX," please state what you gather from the disclosure of the features generally designated "J" therein, with respect to the character of mounting and arrangement of the attempted by-pass valve of these several exhibits before you.

A. In "Defendant's Exhibit XX" I believe "J" to represent a chamber in which there is a plug cock, or valve, substantially as indicated in "Berry Blueprint No. 1". This valve is of necessity in contact with its seat at all times, or such matter as may lodge upon the seat, and is therefore supported thereby. It is intended to be turned upon the seat by a stem and lever connection actuated from the cylinder "P" on the right-hand side, through the intervention of connecting links, which links also rotate the collar "R" and the gates "T". This collar "R" is evidently carried upon the sleeve "S", actuating also the gate "T" on the left-hand side.

RDQ. 603. From the showing of this Exhibit XX, has or has not the valve supposed to be in the casing "J" any other form of support or bearing than that afforded by the inner walls of the casing itself?

Mr. Westall: Objected to as calling for a mere guess of the witness, it being very evident that only the outer casing is shown in the exhibit referred to, and that unless the witness is equipped with an X-Ray gaze he cannot possibly observe what is contained inside of the casing.

Mr. Blakeslee: We do not assume that counsel now contends that there is any further casing than the outside casing, for in that case counsel would be contending that this photo print does not agree with "Berry Blueprint No. 1." We are assuming that the testimony of the witness ^{for} the defendant does not tend to establish a variance between these two purported showings of the same apparatus, and it is upon that testimony introduced by the defendant that we ask this question.

A. I cannot conceive how it could. From the testimony I have heard and read in this case I am convinced that it could not have any other support.

Mr. Westall: I move that the latter part of the answer as to the testimony read be stricken out as not responsive to the question, and involving an interpretation and conclusion which may be erroneous and which the witness has not fully explained, and which cannot properly be explained as part of the record.

RDQ. 604. By Mr. Blakeslee: Is there any showing on this "Defendant's Exhibit XX" to indicate any means of support of the purported by-pass device further than it may be in the casing "J", other than the round

surfaces of the casing "J", which contact with the periphery of the valve or its rounded working surface?

Mr. Westall: Objected to as assuming a construction which has not been shown to be the construction of the part referred to in the question, and on the ground that it is assuming that there is a frictional contact between the valve and its casing, and that the plug is not otherwise supported than by the casing.

Mr. Blakeslee: We will withdraw the question if counsel will admit the possibility of a variance between the showing of this exhibit and "Defendant's Exhibit Berry Blueprint No. 1." Otherwise the objection must fall.

Mr. Westall: Counsel will make no admission of any kind. The objection is simply to the assumption made by counsel as to the inner working and the interior arrangement of the part which is shown in the exhibit.

Mr. Blakeslee: If defendant's record left open a possibility of surmise as to these things, the court is not properly informed as to the construction of this Power Development Company plant set up by the defendant. That being the case, it is highly proper that we attempt to inform the court as far as the exhibits permit us to do so.

A. It certainly does not show any other support.

RDQ. 605. In this "Defendant's Exhibit XX" what means, if any, are provided for supplying energy in any manner to cause the operation of the part "P" and any parts which may be connected therewith?

A. From my knowledge of hydraulics, rams and cylinders as they are frequently used in hydraulic practice, I would consider that the device having the supplement-

ary piston connected at "A" and said device appearing slightly to the left of the cylinder "P" in smaller dimensions, but cylindrical, is a valve chamber having therein a valve connected with a rod at "O", and the lever "N" for controlling the flow of fluid to the cylinder "P". This evidently was the original intention of this device. However, there are no fluid connections anywhere observable to it, so that the device must, as here shown, have been inoperative, as pressure fluid of some kind would be essential to cause the operation through the cylinder or arm "P". Connections from the lever "M" evidently exist or were intended to exist up to the controller. But with the device as shown in this "Defendant's Exhibit XX," movement of the lever "M" would cause movement of the lever "N" and the piston "O", but without pressure fluid of the parts "QQ, K, R, T" or the by-pass valve or water gates, could possibly occur. In other words, the control element could not by the device herein shown cause any operation either of the water-wheel gates of the by-pass valve.

RDQ. 606. Referring again to "Defendant's Exhibit Berry Blueprint No. 1," and to the parts and features therein, which we have last referred to, namely, the apparently intended hydraulic cylinder "25" with its piston and piston rod "27" and the pressure fluid admitting-and-discharging valve "24", and the lever "21", link "22", stem "23" of such valve "24", and their various means of connection, all being apparently joined with the parts which extend to the attempted by-pass device and the water-wheel gates for actuating the same, will you please state what you understand, by this blue-

print supplemented by your understanding of the same in the light of the testimony of the witnesses in this case who have treated of these parts, the action of such parts would be and the effects of such action.

A. I agree with the other witnesses in that the tendency to action would be as they have testified, providing this valve mechanism were supplied with proper pressure fluid; but I disagree with any testimony which is to the effect that this apparatus would be operated responsive to speed changes, or that synchronous, inverse and satisfactory operation of the by-pass valve "41" and the water gates as indicated at "48" could possibly exist to maintain normal speed on the water-wheel shaft under load changes coming upon the generator.

RDQ. 607. What have you to say further with respect to the action of these parts and features directly with relation to the movements or offices of the valve "24" within its case, and the effects of its performance upon the water-wheel gates and attempted by-pass device?

A. The movement of the pilot valve "24" in "Defendant's Exhibit Berry Blueprint No. 1" in a direction toward the wheel shaft would permit pressure from the central pipe shown immediately over the figures "24" to be admitted to the upper portion of the cylinder "25", causing its piston rod "27" to move in a direction away from the wheel shaft center. This movement of the rod "27" would, through the agency of the lever "21", momentarily fulcrum at "20", causing a shifting of the valve "24" in a reverse direction from that which it originally pursued and toward the operation of the rod

“27”, and, therefore, such movement of the rod “27” would reverse the movement of the valve “24” to a position cutting off the further supply of fluid to the cylinder “25”, and, therefore, stopping its action upon the rod “27” to open the water gates and by-pass valve connections.

RDQ. 608. Now, considering further the disclosure before you as of “Berry Blueprint No. 1,” now assume the fact that the lever “21” is indicated as connected up with the dynamometer device which we have previously discussed, and assume that the actions you have just described have taken place under some change of position of the parts of this dynamometer, and that an attempted correction of the water wheel speed is being made, in result of such performance, what have you to say further as to the action of the parts which you have last considered?

A. A speed change and load change might occur without movement of the dynamometer parts. But if, whether it be for load or a combined load-and-speed change that the dynamometer parts may have moved, such movement will cause a corresponding and proportional movement of the lever “21” which will for the moment fulcrum about the pivot “28”, therefore causing the proportional movement of the rod “23” and the valve “24”. Any movement of this valve “24” results in immediate movement of the piston “26” in a reverse direction, causing the bringing back of the valve “24” to its normal or closed position. There will, therefore, occur following any movement of the dynamometer parts a proportional movement first of the valve “24” and, therefore, a proportional movement of the piston “26” in an inverse di-

rection thereto. This, of course, assumes that there is power fluid available for the operation of the piston "26" through the valve "24", this being fed through the central pipe over the figure "24" into one end of the cylinder "25", and being discharged from the opposite end of the said cylinder through one or the other of the two discharge pipes, as indicated by the arrows.

RDQ. 609. After this valve "24" has been brought back to its seat in the governing or attempted governing action, will it or will it not remain there until the governing action has been completed, and give your reasons.

A. It is not brought back until the governing action has been completed, as regards the governing action of a single movement of the dynamometer elements. If there is a further movement of the dynamometer elements as a result of any movement of the water gates now following, there will be a corresponding further disturbance of the valve "24" and the piston "26". Such movements will occur following every movement of the dynamometer movable element if the device works as it was intended it should.

RDQ. 610. And what will be the result with respect to prompt and proper establishment of the proper new condition or position of the water-wheel gates and of the purported by-pass device if it accompanies water-wheel-gate movement?

A. Some portion of the governor in operative combination with the speed-sensitive device thereof should be in engagement during the entire period of speed return from its disturbed condition to its normal condition after the gates have been set in motion. Such is not the

case in this device, because the device would operate so that upon a displacement of the weights or movable parts of the dynamometer from normal position, due to an abnormal load or load-and-speed, the gates will or should take with this device, a new position for such new condition. The valve "24" being thereupon closed to its normal position by the movement of the piston "26", as I have previously testified, the entire device is now in equilibrium at the increased or decreased load or load-and-speed changes, at a higher or lower speed than normal. There is now no tendency for it to return to normal speed, and it will remain in such equilibrium at the higher or lower than correct speed indefinitely, thus failing to accomplish the primary essential of speed regulation. There is no device in this apparatus in operative engagement to prevent the over or under-running of the governor, or to return the speed to normal before it has overrun.

RDQ. 611. And in default of such ever-running preventative, what occurs with respect to the parts we are discussing, including the valve "24", the piston "26", and the connecting parts or what is missing as applicable to these features to prevent over-running of the governor?

A. The effect will be that the voltage will be higher or lower on the system than normal, for an indefinite period. Change would result in incandescent lights burning higher or more brightly or being dimmer than they normally should be. If this device were sufficiently sensitive to be actuated for reasonable changes of speed, the governor would "hunt", that is, over-travel back and

forth, first raising and then lowering the speed through a series of cycles, causing the flickering of lights. This condition would occur whenever the load changes were great enough to overcome the heavy friction involved in this type of dynamometer. The effect would therefore be in cases of considerable load change or load-and-speed change, that the governor would "hunt" or overrun to a defective, if not dangerous degree; or else, if the load change or the load-and-speed change were very small, the result would be a decrease or increase in the speed and in the illumination of incandescent lights supplied therefrom. I might say that this governor will invariably overrun, if it controls at all, and that to prevent such overrunning it would be necessary to add a further element compensating for the rate of speed return to normal, and holding the valve "24" upon its seat during the said return to normal instead of permitting it to overrun as it would do if the said valve "24" were connected up as shown to a speed-sensitive element or a speed-and-load sensitive element or load-sensitive element. This is the element mentioned in the first part of my answer as essential where a speed return to normal is desired.

RDQ. 612. In other words, it is correct to say that in this "Berry Blueprint No. 1",—or is it correct to say that there is any lack of an element which causes the valve "24" to return to its normal or closed position and to stay there during the final movements of the speed-sensitive or load-sensitive or speed-and-load sensitive device, whichever may be utilized to actuate this valve, so that the valve shall not permit the piston "26" to act in a disturbance of the water-wheel gates from the new

position assumed by them consequent upon a change of speed or load.

A. No such element exists in this device as disclosed in "Berry Blueprint No. 1." And the operation of the device as here disclosed would be that the gates would take an improper position for the final new load, and either maintain this position, resulting in an incorrect speed, or would move back and forth a number of times in an effort to find such speed. This applies whether the dynamometer form of sensitive device be used or a speed-sensitive device be used.

RDQ. 613. Therefore, is there or not disclosed in "Defendant's Exhibit Berry Blueprint No. 1" the means for performing the functions of a returning device disclosed in "Complainant's Exhibit A," the patent in suit, and including the clutch-discs "22" and "23" and the rod "25", the springs "27,28" and the means for throwing into and out of connection such enumerated parts.

A. No such device or its mechanical equivalent exists in the device disclosed by "Berry Blueprint No. 1," or "Defendant's Exhibit XX," or "Defendant's Exhibit MZ," or "Defendant's Exhibit Cobb Blueprint No. 1."

RDQ. 614. And how with respect to the functions of these last enumerated parts and the functions of the "Berry Blueprint No. 1" device we were discussing?

A. No such functions are found in the said defendant's exhibits.

RDQ. 615. You heard the testimony of Mr. S. L. Berry, a witness on behalf of defendant in this case?

A. Yes, sir.

RDQ. 616. Referring to the testimony of Mr. Berry

Berry contained in the question and answer number 196 on page 912 of the record, and in which Mr. Berry says: "The power cylinder 'FF', together with the piston head within said cylinder, the piston rod connected thereto, do not form a clutch-gear nor do they in any manner perform the functions of a clutch-gear. Will you please compare these parts with respect to their clutch-gear actions and functions, and specify in what respects?

A. The fluid-actuated piston in the cylinder of the Lombard governor acts in every respect the part of a clutch in mechanics, in that it causes connected operation or interruption in operation of the parts connected thereto and intended to be operated on governor movement. Such is the function of all clutches in mechanics.

RDQ. 617. Are you able to produce any certified copy of the record of the Patent Office of any patent application resulting in any patent issued to Lombard or to the interests of the Lombard Governor Company of Ashland, Massachusetts, which patent issued subsequently to the patent in suit?

Mr. Westall: Objected to unless it is shown that such patent had some bearing in some way upon the issues of this case.

A. I am. I have such certified copy. (Witness produces certified copy of file wrapper and contents of patent issued to Nathaniel Lombard, assignor to the Lombard Governor Company, March 18, 1902.)

Mr. Westall: In view of the answer and the production by the witness, the question is objected to as incompetent, irrelevant and immaterial, and as not proper rebuttal. If it is desired to introduce this file wrapper

because of any statements or admissions by any third person not a party to this suit, it is objected that any such admissions or statements would be mere hearsay and an entirely improper method of proof.

A. This file wrapper indicates the application to have been filed by the said Nathaniel Lombard on December 12, 1901.

Mr. Blakeslee: This line of evidence, as we will show, pertains to the state of the art, including the invention of the patent in suit, and to the alleged infringing structures, and will be shown to be proper rebuttal in dealing with these alleged infringing structures, and the testimony and evidence adduced on behalf of the defendant with respect thereto. The certified copy of the record of the Patent Office constituting this certified copy of the file wrapper and contents is, we contend, competent evidence as to the state of the art at times pertinent to the pendency of this application, and as to the state of the art as admitted by the applicant for the Lombard patent in question by his volunteer disclosures pertinent to this invention, as a matter of public record, under the certification made. And it will be seen that this application, although filed after the application for the patent in suit, was co-pending therewith and was, therefore, part of the state of the art directly before the Patent Office at the time that the application for the patent in suit was pending.

Mr. Westall: It is objected that the certified copy referred to in the first place is not proper evidence of the state of the art at the time referred to, it being composed of statements, perhaps admissions, and arguments

to the Patent Office by a person not produced and sworn in this case as a witness, and, therefore, there is no opportunity afforded for the cross-examination of the person or persons making any such statements as to the alleged condition of the art at the time mentioned. Furthermore, both the application and the patent granted thereon, if such a patent were granted, were made after the application for the Lyndon patent in suit, and long after the alleged invention of the patentee of the Lyndon patent in suit. They therefore could not by any possibility show the state of the art prior to the Lyndon invention or prior to the date of the application for the Lyndon patent in suit, and, therefore, are entirely incompetent, irrelevant and immaterial. Objection is also made that said purported patent has not been in any way connected heretofore with any of the alleged infringing devices or any of the devices which have properly been inquired about during the progress of taking proofs in this case.

Mr. Blakeslee: Further, as will develop, the subject matter of these letters patent concerned in this certified copy of the file wrapper and contents will be compared with certain parts of the alleged infringing construction, and thus it will be made clear by proper proof of connection between the two that this is proper evidence, pertinent to the understanding and explanation and consideration of said part of the alleged infringing structures. The document is not offered, of course, for more than it is worth as evidence; but its pertinence to the issues will be developed as its consideration develops by proper comparison.

Mr. Blakeslee: Complainant offers in evidence the certified copy of the file wrapper and contents just produced by the witness, as "Complainant's Exhibit Certified Copy of File Wrapper and Contents Lombard U. S. Patent 695464."

Mr. Westall: Counsel for the defendant objects to receiving in evidence the paper offered upon the ground that it is largely in the nature of hearsay evidence, in that it consists of correspondence between an applicant and the Patent Office, in which arguments and statements are made by persons who are not produced and sworn to testify as witnesses, which thereby results in a deprivation of every opportunity for cross-examination on the part of the defendant. The objections to the consideration of this exhibit and the questions relating to it, are also repeated as objections to the introduction of this exhibit in evidence.

Mr. Blakeslee: Counsel's attention is called to the fact that the application involved in this certified copy of the exhibit was, as shown, allowed upon the first action of the Patent Office and there is no argument reflected as between the Patent Office and the applicant. However that is merely an observation for the purpose of the record.

Mr. Westall: Notwithstanding the want of correspondence between the applicant and the Patent Office pointed out by counsel, the contention will doubtless be made that an argument is implied or an admission is implied by the Patent Office in the statements made by the applicant, by failure on the part of the Patent Office to correct, object to, or disagree with any statements made

by the applicant, and, therefore, this implied admission might be construed of as great weight as an express statement by the Patent Examiner that he did agree with the matter contained in the application.

(The said document so offered in evidence is thereupon marked "Complainant's Exhibit Certified Copy of File Wrapper and Contents Lombard U. S. Patent 695464.")

RDQ. 618. By Mr. Blakeslee: Do you know whether there is any connection between this Lombard Company, the assignee of this patent in this exhibit, and the Lombard Governor Company which has been testified to be the manufacturer of "Complainant's Exhibit W," and other governor mechanisms referred to in this case?

A. They are one and the same company.

RDQ. 619. Is there any comparison possible between the disclosures of this patent and the patent a copy of which is included within this exhibit, and within the certification thereof, and "Complainant's Exhibit W?"

A. Yes.

RDQ. 620. In what respects?

A. "Exhibit W" exemplifies and contains the invention set forth in this patent No. 695464.

RDQ. 621. Now, with respect to the alleged infringing structures as depicted in "Complainant's Exhibits E to L, Photographs," and further exemplified by other of complainant's exhibits depicting the alleged infringing structures, such as "Complainant's Exhibit KKK," is it possible to trace any relation between the disclosure of this exhibit and such other complainant's exhibit?

A. The device disclosed in this Lombard patent No.

695464 is in use in the Lombard governors at the Cottonwood and Division Creek plant of the City of Los Angeles on the Los Angeles Aqueduct System as exemplified in "Complainant's Exhibits KKK and LL."

RDQ. 622. Will you please read from this file wrapper and contents exhibit such excerpts as you may make

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shall throw light upon the operation and functions of the structures including "Complainant's Exhibits E to L," and "KKK" and "LL", and as likewise relating to the construction and inter-relation of parts in "Complainant's Exhibit W."

Mr. Westall: It will be understood that all objections heretofore made to the consideration and to the introduction in evidence of the exhibit referred to in the question are renewed and repeated to all the questions relating to the exhibit, without burdening the record by their repetition after each question.

A. Reading from the certified copy of the file wrapper and contents of U. S. Letters Patent 695464, issued to Nathaniel Lombard, assignor, and assigned to the Lombard Governor Company, in the specifications forming part of said Letters Patent I find, commencing on line 9 of page 1: "The improvements relate to speed-regulators, particularly of the class shown and described in my Letters Patent No. 533,656, dated February 5, 1895, in which the valve that regulates the speed of the engine, or other prime motor, is opened and closed by the movement of weights which are acted upon by cen-

trifugal force when they are revolved; and my invention consists in improvements in the construction shown in said patent by which said valve is quickly, yet moderately, returned to its normal position, whenever that has been disturbed by the action of said revolving weights, and by this means the so-called 'racing' of the engine or prime motor is prevented, as also the pounding of fluctuation from one extreme of speed to another by reason of the alternate opening and closing of the valve caused by the vibration of the said weights. In my said prior patent this valve is returned to its normal position by the action of a spring which works against liquid in a cylinder which is caused to circulate from one side to the other of a piston therein with greater or less rapidity in accordance with the size of the opening in a manually-adjustable gate in the passage which connects the two ends of said cylinder, while in my improved construction the gate or valve in said connecting-passage is automatically opened and closed when the said cylinder is moved in one direction and then the other. The construction and operation of these improvements will be readily understood from the description hereinafter contained in connection with the accompanying drawings."

And line 71 of page 1: "Like the mechanism shown in my said prior patent, the present improvements are intended to be employed in the regulation of what I term the 'secondary' valve—that is, one which supplies the motive power to mechanism which operates the primary valve or gate that furnishes the motive power to the prime motor. In the first instance the centrifugal governor, which is revolved by direct connection with

the prime motor, acts upon this secondary valve to move it in one direction or the other in accordance with the variation of speed in the prime motor due to a decrease or increase of the load or amount of work put upon it. Such change of the secondary valve supplies the motive force to the mechanism which operates the gate of the prime motor, and by the connection of this mechanism with my improved regulating devices these devices are caused to act immediately upon the secondary valve in a manner to counteract the effect thereon of the last previous action of the centrifugal governor, and thus return the secondary valve to its normal or closed position, and this is the constant tendency of my improvements whenever the secondary valve is moved from its normal position."

Referring to page 2 of the said specifications, commencing at line 44 and referring to the former patent issued to this inventor, to-wit, No. 533656, he says: "The alternate movement of the rod d' with the attached secondary valve first in one direction and then the other by the swinging out and in of the weights c' produces a very injurious effect upon the engine or prime motor by quickly increasing and decreasing its speed, and sometimes when the load is suddenly taken off the prime motor, it will 'race' to such an extent as to cause injury, and my improvements are intended to obviate these difficulties."

The inventor further in his specification, and referring particularly to Fig. 4, commencing at line 108, page 2, says: "The lower end of this rod—g⁵ is beveled off at an obtuse angle upon two sides of a diametrical line, and

beneath the end of the rod there rests upon the projection f a piece of metal g¹⁰, which has a flattened V-shaped groove g¹¹ in its upper surface, the angle of the faces of which groove is the same as that of the beveled faces of the lower end of the rod g⁵, but considerably greater in extent. When the parts are all in normal position, the apex of the beveled end of the rod g⁵ should rest in the bottom of the groove g¹¹, as shown in Fig. 4. The metal piece g¹⁰ is pivotally secured at e⁸ to an angular clamp e⁹, which is bolted to the frame e¹ at e¹⁰. Small h is a screw-plug to close an opening through which the chamber g and cylinder f¹ are filled with liquid, probably oil."

On page 3 of the specifications, line 11, the inventor says: "The operation of my improved construction is as follows: It will be understood that the piece g¹⁰ is prevented from moving horizontally by its engagement with the angular clamp e⁹, which is bolted to the frame e¹, although the end containing the groove g¹¹ may move up and down as required upon the pivot e⁸. Referring to Fig. 4, where all parts are illustrated as in their normal position, with the apex of the angular lower end of the rod g⁵ in the bottom of the angular groove g¹¹ of the piece g¹⁰ and with the rod g³ so adjusted that at this time it closes the port g², we will suppose that suddenly a large amount of load is taken off the prime motor. Immediately its speed will be increased, thus causing the weights c¹ of the centrifugal governor to be thrown outward, which action will draw down the collar c⁴ and by its contact with the sleeve d³ towards it, with the attached rod d¹, downward, and also the secondary valve

on the lower end of that rod. This movement of that valve will open the ports which admit motive power to act upon the mechanism connected with the gate of the prime motor and tend to close that gate. As the lower end of the lever f^4 is connected with the same mechanism, it also will be moved from the position shown in Fig. 4 to that shown in Fig. 6. At the same time the liquid-circulation chamber f^1g and the attached rack e^2 will be moved horizontally to the left, as shown in Fig. 6. This movement of the rack e^2 which is in engagement with the pinion e , will cause the pinion and the rod d^1 to turn from left to right, and thus screw the upper end of the rod into the sleeve d^8 , shorten the rod, and raise it with the secondary valve at its lower end, and thereby tend to close the valve and counteract the previous effects of the centrifugal governor upon it. The movement to the left of the cylinder f^1 and rack e^2 will continue until the port g^2 has been opened sufficiently to permit a free circulation of liquid in said cylinder and the chamber g . The first movement of the upper end of the lever f^4 to the left will carry the cylinder f^1 and its attached mechanism with it, and as the piece g^{10} is secured to the frame the end of the rod g^5 will slide up the inclined surface of one side of the angular groove g^{11} therein, and through the connecting-link g^4 the valve rod g^3 will also be raised, and thus open the port g^2 and permit a circulation of liquid from one side of the piston f^2 up through the port g^2 and down through the port g^1 into the cylinder f^1 upon the opposite side of the piston f^2 . The resistance of the liquid in said cylinder being thus removed from the piston, the spring e^5 , Fig. 2,

by means of a finger e^3 will force the rack e^2 and cylinder f^1 back again—that is, to the right—and the piston f^2 will tend to assume the position illustrated in Fig 6. This reverse movement of the rack e^2 will turn the pinion e and rod d^1 in the opposite direction—that is, from right to left—and unscrew the rod from the sleeve d^3 , thereby lengthening the rod and forcing the secondary valve downward, thus tending to open that valve again. However, as the action of the centrifugal governor by reason of the increased speed of the prime motor tended to open the secondary valve and operate mechanism to close the gate of that motor such closing would decrease the speed of the motor and at the same time the speed of the centrifugal governor, the action of which would tend to close the secondary valve and if otherwise uncontrolled would be liable to continue its action in the same direction and open other ports of the secondary valve, which would admit motive power to set in operation the mechanism to again open the gate of the prime motor; but, as explained above, the movement of the rack e^2 to the right would turn the rod d^1 , so as to lengthen it, and thus move the secondary valve downward, which would compensate for the tendency to raise that valve by the action of the centrifugal governor when its speed of rotation was decreased, so that whenever the centrifugal governor acts upon the secondary valve to put in operation the mechanism which tends to open or close the gate of the prime motor, that same mechanism acts upon the rack e^2 to move the secondary valve first in a direction opposite to that produced by the governor thereon and then automatically and stead-

ily to return said valve to its normal or closed position, and at the same time by automatically closing the port g² between the cylinder f¹ and the chamber g prevents circulation of the liquid, and by that means prevents the movement of the piston in the cylinder f¹. Thus a practically rigid connection between the lever f⁴ and the rack e² will be formed, which will cause the beginning of each impulse of the lever f⁴ to act quickly and positively upon said rack to counteract the effect produced upon the secondary valve by the governor."

RDQ. 623. By Mr. Blakeslee: What if any relation exists between the mode of operation and function of the water-wheel governor disclosed in the patent from which you have just been reading excerpts, and the water-wheel governor of the patent in suit, "Complainant's Exhibit A," with particular respect to the returning devices comprising the clutch disc "22-23", means of engaging and disengaging the same, and means of operating ^{vs} connection between the same and the other controlling features of the governor?

A. They accomplish substantially the same results in substantially the same manner and by substantially the same means.

RDQ. 624. Are you able to produce at this time a photograph of "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," made under your direction?

A. I have, and I now produce the same.

Mr. Blakeslee: The same is offered in evidence as "Complainant's Exhibit Photograph of Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898."

Mr. Westall: Counsel for defendant objects to the offer and to receiving in evidence of the exhibit referred to on all the grounds urged to the original sketch of which the present exhibit purports to be a photographic copy.

(The said photograph so offered in evidence is marked "Complainant's Exhibit Photograph of Complainant's Exhibit Lyndon Reproduction Sketch of His Disclosure Sketch of June and July, 1898.")

Mar. 13, 1915. A. M.

RDQ. 625. Referring again to the installation of the Power Development Company in the Kern River Canyon as purported to be illustrated with respect to the installation in "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit MZ," I will ask you please to assume that the load upon the generator and wheels operated thereby is to be considered as the call for electrical energy, and then to further assume the following conditions of attempted operation: First, an increase of head with an increase of load, together with a constant main-gate opening; second, a decrease in head with a decrease in load, with a constantly maintained main-gate opening; third, an increase in head with a decrease in load, with a constantly maintained main-gate opening; and, fourth, a decrease in head with an increase in load, with a constantly maintained main-gate opening. And then, based upon the interpretations given by your testimony of the action of the dynamometer of this plant in the attempted operation, please state what in each of the cases put would be the accompanying action or attempted action of this dynamometer,

and what would occur with respect to water-wheel governing responsive to each of the particular sets of conditions set forth, dealing particularly with the factor of speed and the effect upon the voltage conditions in the circuits supplied by the generator, due to variations that will occur, particularly considering this speed factor.

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with a properly designed governor and its accompanying apparatus result in the maintenance of a constant speed. With the dynamometer device of "Berry Blueprint No. 1," and "Defendant's Exhibit MZ," because there has been an increase of load, the tendency will be to draw the levers "EE' " inwardly. Depending on the degree of load and head change, there will be either an increase or decrease of speed. Under the second condition you have mentioned, my answer is the same with the difference that the levers will have a tendency to move outwardly. Under the third condition you have mentioned, there being a decrease in the load, the levers "EE' " will move outwardly, corresponding with an increase of speed. In the fourth case you have mentioned, the levers would move inwardly, responding with a decrease in speed. To make this matter clear, the action of the weights and lever "EE' " is caused by load changes and not speed changes, and a great number of different positions and, therefore, speeds may be attained. With the same originally impressed load and

for any given lever position a number of different speeds will undoubtedly exist.

RDQ. 626. Now, particularly with respect to the third and fourth cases, what will be the only possible action of this dynamometer with respect to establishing the proper speed conditions of the water wheel and generator driven thereby?

A. The device will not actuate to maintain a constant speed.

RDQ. 627. And what will be the results from a commercial standpoint of attempting to operate such an apparatus?

A. In practical operation of an electric system supplied from a generator and water-wheel equipment with dynamometer control as indicated on "Berry Blueprint No. 1," assuming it to work as there disclosed, there will be upon increased loads thrown on the apparatus a decrease in speed; and upon decreasing loads an increase of speed. These variations in speed will result in decreased voltage in the first case and an increase of voltage in the second case, whereas, the voltages should remain the same in both cases.

RDQ. 628. And, with such voltage variations, from a commercial standpoint what would be the results?

A. There would be with increased voltage an over-speed of the motors or an over-illumination of the lights, and this over-voltage would frequently result in damage to the lights or motors if excessive. With under-speed and under-voltage there would be a decrease in the illumination of the lights and a slowing-down of the motors. If the apparatus is alternating current apparatus,

as it almost universally is in power transmission work, the increased speed would also correspond with an increased number of cycles, and the decrease in speed with a decreased number of cycles, causing damaging variations in the speed of motors and driven apparatus.

RDQ. 629. Would these contrary and objectionable effects or results be obtained, assuming that a purely speed-sensitive device under the same other conditions were substituted for this dynamometer device?

A. No; they would not, with the speed-sensitive device such as disclosed in the patent in suit.

RDQ. 630. Now, apart from any consideration of change of head, and still assuming the attempted operation of this dynamometer device of "Berry Blueprint No. 1," what would be the effect upon the voltage of the circuit supplied by the generators produced by an increase of load and decrease of load, respectively, assuming the lever arms "E" and "E'" to be at definite positions off their seats.

A. An increase of load will result in the retardation of the speed with its attendant defects. A decrease of load will result in an increase of speed with its attendant defects.

RDQ. 631. And subject to any possible speed-correcting action of this dynamometer, will these lever arms, or will they not, be brought to their normal positions related to any given load?

A. They will occupy always a position of equilibrium between load and speed. That is, for any given position of these levers they will so remain for a proportional

increase in speed and decrease in load, or increase of load and a decrease in speed.

RDQ. 632. Then is it or is it not true that these lever arms may occupy different positions for the same load?

A. That is true.

RDQ. 633. And what is the result of that possibility with respect to the maintenance of a constant speed of the water wheel?

A. A variation in the speed inversely to the load.

RDQ. 634. And what is the effect of such variation with respect to maintaining a proper voltage upon the circuit?

A. It would be impossible to secure satisfactory service under these conditions and with this dynamometer.

RDQ. 635. Then, in order to in any manner approximate proper service with the maintenance of proper voltage conditions upon the circuit, it would be necessary, would it, to correct the position of these levers, after they had once been shifted, by hand or otherwise?

A. It would, either to correct the position of these levers or to compensate for the error of their position, by manual or other means, in order to bring the apparatus to correct normal speed.

RDQ. 636. Then, if that is so, please state whether or not this dynamometer device, assuming it to be operative at all, could in itself perform proper governing action to maintain proper voltage conditions upon the circuit.

A. It certainly could not.

RDQ. 637. And as to such completeness of per-

formance of function, is or is not anything required in addition to the speed-sensitive device and its associated features in "Complainant's Exhibit A," the patent in suit?

A. No.

RDQ. 638. Please state to what extent sensitive-ness in governing action is a necessary condition in modern water-wheel governing in hydro-electric plants?

A. It is absolutely essential to satisfactory service from such plant for an automatic governor to be operatively incorporated therewith to maintain a constant speed of the prime movers. This, I believe, is true of every modern hydro-electric plant without exception, and the success with which the speed is maintained constant is a close measure of the satisfaction derived from the electric service supplied from such station. Roughly speaking, one percent variation in the speed of the apparatus will correspond with from five to ten per cent in the illumination of incandescent lamps. Rapid fluctuations of one per cent in speed in such apparatus will, therefore, result in the flickering of such lamps to an extremely disagreeable degree.

RDQ. 639. Are you able to mention or to refer to by general identification any more or less structurally complicated electro-mechanical structures or devices which have gone into and are in successful operation in both this art and other arts? If so, please refer to them.

A. In this art I call to mind large numbers of Replogle electrical governors, many of which I have built, installed, adjusted and operated, and which were satisfactory devices for accomplishing speed regulation of

water wheels in their day. They were somewhat crude, in that most of the modern governors contain more accurate elements for returning the speed to normal and for preventing the overrunning of the governor. But they accomplished their electrical and mechanical performance with satisfaction. The early electrical service in the San Gabriel Valley was largely under the control of electrical governors, and I believe the original Redlands plant was equipped with these governors. The service at Fresno of the early San Joaquin Development Company was under the control of electro-mechanical water-wheel governors, and the service was built up to a degree of great value during this period. The same sort of governor was used on a plant I recollect in Tuolumne County, California. The Utica mine, one of the largest mines in the world, of Angels, Calaveras County, California, was supplied by a plant from the town of Murphys and was, I believe, under the control of this kind of governor. Electro-mechanical governors were well known in the art as operative devices at the time of the Lyndon disclosure. Electro-mechanical devices in other arts are too well known to require any extensive description. The advertisement of modern railroads which we see so frequently headed as "Safety First," is largely based upon the block signal systems which are almost universally electro-mechanical, and their reliability and certainty of action is certainly beyond criticism.

RDQ. 640. Are so-called electric elevators both electro-mechanical or electro-magnetic and mechanical in their control?

A. They are electro-mechanical in the same sense that the Lyndon governor is an electro-mechanical device.

RDQ. 641. Referring now to "Defendant's Exhibit Wetmore Patent 519597," do you or do you not find disclosed therein any by-pass device for passing water around the wheel?

A. No such device is shown in this patent.

RDQ. 642. Is there therein disclosed any means or system capable of operating in such manner as to bring the water-wheel gate to its proper position subsequent to a change in load or speed of the water wheel, and to hold it there during completion of the governing action, so as to prevent overrunning of the water wheel?

A. No.

RDQ. 643. Then do you or do you not find disclosed in this Wetmore patent any means or system capable of performing the function of the returning device of "Complainant's Exhibit A," the patent in suit, including the clutch-discs "22" and "23", and the parts whereby the same are operatively connected with the remaining features of the governor, and are thrown into and out of operation?

A. There is nothing in this governor of the Wetmore patent intended to or that would perform the functions of the parts you have mentioned in the Lyndon patent.

RDQ. 644. In so far as the disclosure of this Wetmore patent goes, is it a possibly operative electro-mechanical water-wheel governor?

A. It is.

RDQ. 645. Is it electro-mechanical in its organiza-

tion and operation in the same sense, although not for the same purposes, as the disclosure of "Complainant's Exhibit A," the patent in suit?

A. It is.

RDQ. 646. Referring now to "Defendant's Exhibit C. S. English Patent 521085," do you find disclosed therein any by-pass device whatsoever for passing water around the water-wheel?

A. No, sir.

RDQ. 647. Do you find in this English patent any returning device for bringing the water-wheel gate to its proper position to conform with a change of speed or load of the water wheel and to hold it there during completion of the governing action to prevent overrunning of the governor?

A. No; no such parts or devices are disclosed in this English patent.

RDQ. 648. Do you or do you not, therefore, find disclosed in this English patent any features capable of performing the functions of the returning device disclosed in "Complainant's Exhibit A," including the clutch-discs "22" and "23" and the devices whereby the same are operatively connected with the other devices of the governor, and also the features for throwing the same into and out of operation?

A. I do not.

RDQ. 649. From the disclosure of this English patent is this English water-wheel governor a possibly operative electro-mechanical water-wheel governor in the same sense, although not for the same purpose, as

the disclosure of the patent in suit is an electro-mechanical water-wheel governor?

A. It is.

RDQ. 650. In the disclosed operation of each of these electro-mechanical water-wheel governors disclosed in the Wetmore and English patents just discussed, what will occur with respect to shifting of the water-wheel gate or gates responsive to governing action?

A. There will be an overrunning of the speed of the wheel controlled by either of these governors, and "hunting" by the governor, as a result thereof. This "hunting" will cause a surging up and down of the speed and of the voltage of the system.

RDQ. 651. And with what results, from a commercial standpoint?

A. The voltage surges will cause all the disastrous effects to the service previously testified to.

RDQ. 652. And with such a governor, built as each of these, applied to a water wheel in the attempt to regulate the same, what would occur with respect to inertia conditions in the pipe line or penstock upon opening and closing the water-wheel gates?

A. There would be great reductions and increases of pressure, the degree of which would depend upon the pipe line conditions, unless some other device were used in combination with the governor and as now known in the art, but at the time of the disclosure in these patents unknown.

RDQ. 653. Referring now to "Defendant's Exhibit Lamb Patent," do you or do you not find therein any

by-pass device for passing water around the water wheel?

A. I do not.

RDQ. 654. With respect to the supply of water to the wheel in accordance with the disclosure of this Lamb patent, what is the application of the supplied water?

A. It is applied tangentially through a number of nozzles to the buckets of the water wheel.

RDQ. 655. In what sense applied tangentially?

A. From a casing through nozzles tangential to the buckets.

RDQ. 656. How much of the water so supplied strikes the wheel?

A. In Fig. 1 of the patent, water is supplied through five of the six nozzles therein shown against the buckets of the wheel.

RDQ. 657. And through the other of the six nozzles?

A. The sixth nozzle is shown as an alternate nozzle to supply water in the opposite direction against the backs of the buckets, performing thereby a braking effect upon the speed of the wheel.

RDQ. 658. Then how much of the total water supply strikes the wheel, considered as a unit?

A. All of the water that may be flowing at any one time strikes the wheel either in one direction or the other.

RDQ. 659. And how much of the water supplied or controlled by this governor in any respect strikes the wheel?

A. All of the governor-controlled water strikes the wheel.

RDQ. 660. And in the use of the by-pass device what have you to say with respect to the extent to which all the water controlled by the governor strikes the wheel?

A. In the by-pass nozzle all that water corresponding with any reduction of load is cut off by the governor from the wheel, and some or all of it is diverted through a by-pass entirely independent of the wheel.

RDQ. 661. And is that equally true whether you have a by-pass nozzle or any other form of by-pass arrangement?

A. That is true generically of by-pass devices in the art.

RDQ. 662. In the use of a governor like that disclosed in the Lamb patent, is there or is there not any possibility of saving any water in connection with maintaining proper wheel speed, and at the same time preventing the undue action of inertia effects in the pipe line?

A. There is not.

RDQ. 663. In the use of such governor device as that of the Lamb patent is there any variation of the amount of water passed to the wheel, although the load on the wheel varies?

A. There is not.

RDQ. 664. What have you to say with respect to the governor of the patent in suit in these respects?

A. In the governor of the patent in suit with its associated by-pass device, upon action by the governor to

vary the water quantity impinging upon the water wheel, the change effected in the water quantity is reflected in a corresponding change in pipe-line velocity, accomplishing water economy through the slow closing action of the by-pass valve, if the valve be arranged for slow return to its normal position. If, on the other hand, the slow return to normal position is not used, the inertia effects are with equal degree prevented, but water economy would not then be accomplished. The slow closure to normal position is, I might say, used most frequently for water economy.

RDQ. 665. And in the use of the governor in the patent in suit is or is not the amount of water supplied to the wheel varied in accordance with the load imposed upon the wheel?

A. It is directly in proportion thereto.

RDQ. 666. And is there any such variation of the supply of water in connection with the Lamb patent governor?

A. No.

W. W. WILSON, heretofore sworn and examined on behalf of complainant, being recalled, in response to interrogatories propounded to him by Mr. Westall, testified as follows:

CROSS-EXAMINATION.

By Mr. Westall:

XQ. 91. Mr. Wilson, have you had an opportunity before being examined as a witness to examine "De-

fendant's Exhibit Berry Blueprint No. 1," which I now show you?

A. No, sir; I think the only time I have seen that was on direct examination.

XQ. 92. And you had not seen it before you were examined in your direct examination?

A. No, sir.

XQ. 93. Are you sure from the brief examination that you were able to make of the exhibit referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," that you understood the nature, objects and purposes of the different devices therein shown and illustrated?

A. The general principle of operation I understood. I do not know whether I went definitely into the action of the governor and those parts of it, or not.

XQ. 94. Did you read any of the testimony or did you have the substance of any of the testimony heretofore given in this case explained to you before you testified as a witness in this case?

A. No, sir.

XQ. 95. Had you been told in a general way what had been brought out by the examination of prior witnesses concerning the operation and construction of the water-wheel governor used at Bakersfield approximately in 1896 and 1897, known as the Girard governor?

Mr. Blakeslee: Objected to as indefinite and calling for a legal conclusion and not for a statement of facts, and that it is not the proper method of proof.

A. Mr. Henry and Mr. Blakeslee and I compared notes somewhat on that type of governing device. No instructions were given me on that matter outside of

comparing and sort of checking up what I knew about governing devices.

XQ. 96. By Mr. Westall: And what, if any, conversation did you have respecting the by-pass valve of the plug-cock type which you have testified concerning on your direct examination?

A. Mr. Henry, I believe, as shown in the direct examination, showed me some sketches which he had made up previous to the direct examination, which I looked over.

XQ. 97. Had you seen those sketches before you testified?

A. That day; yes.

XQ. 98. How much time did you spend in examining and comparing those sketches before you were called as a witness to testify?

A. About ten minutes, I suppose, would cover the entire time.

XQ. 99. And prior to that time had you compared those sketches with any of the exhibits in this case or copies of any of the exhibits illustrating any of the devices said to be used at Bakersfield in 1896 and 1897 by the Power Development Company?

A. No, sir.

XQ. 100. You had not compared any of those sketches prior to that time with "Defendant's Exhibit Berry Blueprint No. 1?"

A. No, sir. As I remember it now, the first time I saw "Berry Blueprint No. 1" was when it was shown to me in the direct examination.

XQ. 101. Since you have testified as a witness have

you been told what has been testified or what the substance of any testimony that has been given was regarding such Bakersfield devices referred to in my last question, and particularly the by-pass illustrated in "Defendant's Exhibit Berry Blueprint No. 1"?

A. No, sir; I don't think we have had any conversation at all since I testified.

XQ. 102. No conversation concerning any testimony which had been given by you, or any testimony which had been given?

A. No, sir; from the time I testified directly until the present.

XQ. 103. Do you understand fully the construction illustrated in "Defendant's Exhibit Berry Blueprint No. 1" at the points marked "41", "42", "43" and "49", and adjacent thereto?

A. Yes, sir.

XQ. 104. What do you understand is disclosed in the blueprint last referred to at the place I have indicated?

A. That is a rotating cylinder valve connected on one side with the water main and on the other side with the tailrace, and operated by the rotating cylinder to open or close the valve.

XQ. 105. Do you understand that the part marked "41" in "Defendant's Exhibit Berry Blueprint No. 1" is a cylindrical plug inside of the casing?

A. Yes, sir; with a hole through it. The part shown at "41" is a section of the cylinder through the hole.

XQ. 106. And do you understand what frictional contact there is between that plug and its casing, if any?

A. Frictional contact due to pressure of the head. That is, the difference of the pressure on the head side and the tail-race side of the valve to cause the plug to rest against the side of the cylinder in the casing.

XQ. 107. What do you understand to be disclosed by the dotted lines in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and especially by the part which I have marked "A" in red on said exhibit.

Mr. Blakeslee: Objected to as not cross-examination, the witness manifestly showing by his testimony not to have made any further examination of the exhibit than a mere casual inspection of it during his direct examination, and as assuming that the indefinite dotted lines referred to are capable of interpretation to show anything positively and without extreme doubt and uncertainty; and calling for a conclusion on the part of the witness and not for a statement of facts, and not the proper method of proof, irrelevant, immaterial and incompetent.

A. It shows the casing surrounding the cylindrical valve in the by-pass.

XQ. 108. By Mr. Westall: How do you understand from those dotted lines that the plug within this casing is supported?

Mr. Blakeslee: The same objection.

A. It is controlled evidently from the shaft. I cannot say how the support is maintained. It is not shown at "41".

XQ. 109. By Mr. Westall: Would not the point that I have marked "A" indicate to your mind that a trunnion in a bearing supported one end of the plug,

and that the other side adjacent to figures "41" and "42" was supported by a bearing at that point?

Mr. Blakeslee: The same objection, and further that it is argumentative, not proper rebuttal cross-examination in any respect, this not being the time and place for the defendant to make out any part of its case from defendant's own evidence and exhibits.

A. The shaft controlling the cylinder evidently extended through into the casing at the side at "A", and I am unable to state whether any bearing is fitted there or whether it is on the edges of the cylinder, from the blueprint shown.

XQ. 110. By Mr. Westall: You would naturally infer from an examination of the figure to which I have referred, namely, Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and the dotted lines showing this casing and by-pass valve, that this plug was either supported by a trunnion at the point which I have marked "A" in red on said drawing, or was supported by a shaft extending through the plug, would you not?

Mr. Blakeslee: The same objection, and as purely argumentative and a manifest attempt on the part of counsel to put words into the mouth of the witness, not calling for a statement of facts in any respect, and up^{on} each of the other grounds included in the last objection and repeated objection, and particularly this question does not call for a statement of facts but for a mere inference which manifestly is all that could be possibly drawn, and if so drawn would not be a statement of facts.

A. It all depends on the amount of clearance exist-

ing between the different parts of it, which I am unable to state, due to the inaccuracy of the drawing.

XQ. 111. By Mr. Westall: I do not believe that the witness has thoroughly understood the question, as the answer is clearly not responsive to it. I will therefore ask that the Examiner read the question, and that the witness again give it consideration.

Mr. Blakeslee: We object to this stringing out of the record by re-reading any such indefinite and purposeless questions, which, if it was not understood, was simply because there was no question at all capable of being answered by any statement of facts.

(The Examiner reads the question to the witness.)

A. That is owing to whether there is greater clearance between the cylinder and the shaft than between the shaft and the casing on the ends or not.

XQ. 112. By Mr. Westall: It is not a question whether the plug bears on the casing or on shafts, but whether you would infer from an examination of the parts of the drawing to which I have referred that either a trunnion or a shaft was extended through the plug, or for any reason whatever.

Mr. Blakeslee: The same objections, and all of them. It is manifest that this is merely an attempt of counsel for defendant to enlarge or modify the showing of the blueprint in question, which apparently he did not dare to do when he was examining his own witnesses, and the only inference to be drawn from such procedure is that he is taking a desperate chance at the present time which he was afraid to take when he was examining his own witnesses, and, therefore, the only possible testi-

mony that can be adduced from such examination would be open to the most radical criticism as to its accuracy due to the indefiniteness and lateness of the entire procedure.

Mr. Westall: We again call counsel's attention to the rule which prohibits argumentative objections, to-wit, Equity Rule 51.

Mr. Blakeslee: And we call counsel's attention to the fact that under the rule on which these proofs are being taken, witnesses are to be interrogated as to facts and are not to be argued with and coaxed to conform to the expressions of counsel which are merely argumentative assertions, and this whole line of procedure is manifestly not cross-examination or proper cross-examination of any kind, and the blueprint speaks for itself, and inferences and mere inferences may be made by counsel at the final hearing, but his inferences are not properly to be attempted to be used as the inference of the witness.

Mr. Westall: We admit that the blueprint speaks very largely for itself as to the particular point under examination.

A. I am unable to say whether the point "A" is at the center of the cylinder or above or below at the point shown. It may be an extension of the shaft or trunnion or it may be above or below, which would make it some point on the side of the valve casing.

XQ. 113. You will notice a vertical line drawn through the pipe "46" on Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and you will notice that that vertical line is intersected at right angles by hori-

zontal lines which pass to the right of the pipe close to the figures "42". I will ask you to please examine those two lines and state whether or not this trunnion or extension of the shaft is not exactly opposite the operating shaft of the plug by-pass valve?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, as the question cannot in any manner determine the horizontal plane of the axis of the plug-cock.

XQ. 114. By Mr. Westall: In other words, is not the horizontal line last referred to coincident, or intended to be coincident, with the axis of the shaft operating the plug within the casing?

Mr. Blakeslee: And further objected to as assuming that there is any shaft at all shown in this blueprint.

A. The only manner in which that could be determined is by another section, which is not shown, through the horizontal line through the plant "42". If a section was passed vertically through this line, by that means you could determine whether it was an extension of the shaft or trunnion or what its condition was.

XQ. 115. By Mr. Westall: You are satisfied that that was intended by the draughtsman to represent either an extension of the shaft or a trunnion supporting the plug within the casing, are you not?

Mr. Blakeslee: The same objection and as misleading, by directly contradicting one of the assumptions of the witness in these respects, and upon all the cumulated grounds of the objection last urged.

A. No; I am not able to state positively, due to the fact that I have seen mistakes made in that way before,

and the drawings are not shown with sufficient sections.

XQ. 116. By Mr. Westall: What would you infer or surmise would be the purpose and object of the construction attempted to be illustrated in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" at the point I have marked "A" in red?

Mr. Blakeslee: The same objection, and also because counsel is descending further in the scale of proper examination of the witness to a point of mere surmise, which is too low beneath the level of any fact to produce any testimony which could be considered at all.

A. It might be a trunnion or it might be a lug at the side of the casing, and it might be a by-pass around the end of the cylinder. You cannot determine from the drawing at the point "A."

XQ. 117. By Mr. Westall: You say it might be a lug. Is there any indication upon "Defendant's Exhibit Berry Blueprint No. 1" in any place that a lug is used at that point for any purpose whatever?

Mr. Blakeslee: The same objections and all of them.

A. That is the only view of that particular section that is shown. The total of one part of the drawing is cut away in the section as shown in Fig. 4.

XQ. 118. By Mr. Westall: So far as you know, there is no reason why a lug would be needed at the point marked "A" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," is there?

Mr. Blakeslee: All of the same objections are repeated.

A. No, sir.

XQ. 119. By Mr. Westall: Then it would be rea-

sonable, would it not, to believe that the part marked "A" in Fig 2 of "Defendant's Exhibit Berry Blueprint No. 1" is either intended as a trunnion or is intended to show the end of the shaft "42"?

Mr. Blakeslee: All of the same objections, and further, that the witness's belief without any foundation for the belief other than as shown by the testimony, is absolutely immaterial.

A. It might be; yes. I am not willing to go on record as stating that that is what it is, because I don't know.

XQ. 120. By Mr. Westall: But you are willing to state that that is a fair, logical and reasonable conclusion from the examination of Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," are you not?

Mr. Blakeslee: All of the same objections.

A. No. I don't know anything about that drawing outside of what it discloses, and it has not got the particular section to show what that is and I cannot state positively what it is.

XQ. 121. By Mr. Westall: I am not asking you to state positively, but I am asking you whether it would not be logical or reasonable to suppose that the point marked "A" in the figure referred to in "Defendant's Exhibit Berry Blueprint No. 1" is either a trunnion or the end of the shaft supporting the plug within the casing?

Mr. Blakeslee: All the same objections, and, furthermore, it makes no difference what is logical and reasonable. The witness testifies that he does not know what it is, and that is an end of the inquiry.

A. I would not say it would be.

XQ. 122. By Mr. Westall: Without stating that it would be, do you believe that it would be?

Mr. Blakeslee: The same objection, and furthermore, that the question has been answered again and again, and we object to stuffing the record with any such purposeless reiterative questions.

A. I am not willing to say. I know nothing about the design of that particular part of the machine.

XQ. 123. By Mr. Westall: Without knowing anything about the design of that particular part of the machine, I am asking you only to look at the drawing and from that superficial examination, without knowing more, to say whether it would not be entirely logical and reasonable to suppose that that was either the end of the shaft "42" or a trunnion?

Mr. Blakeslee: The same objection, and counsel by his question admits that knowledge by the witness has now been entirely eliminated from the inquiry, and, therefore, to answer the question cannot possibly be of any use in these proceedings, the witness having testified further to the best of his knowledge, judging from his inspection of this blueprint. Counsel is manifestly attempting to continue to testify himself without being sworn, and is making observations which can only be properly addressed to the court as being his own conclusions, guesses and hazards.

A. As I said, it may be or it may not be. I am not willing to say that it is a reasonable conclusion or not. It is owing to the complication of the machine and the purpose of it as to how many parts there might be there-

on, and as to whether that would be a shaft or trunnion or whether it was some other appendage on the side of the casing.

XQ. 124. By Mr. Westall: There being no reason for any other lug or appendage on this drawing, namely, "Defendant's Exhibit Berry Blueprint No. 1," so far as the construction thereof is concerned, it would be more reasonable, would it not, to suppose that the part which I have marked "A" in Fig. 2 of such exhibit is a trunnion or the end of the shaft than to suppose that it was a lug, would it not?

Mr. Blakeslee: The same objections, and all of them, and we move to tax the cost of taking and returning the cross-examination of this witness to the defendant, in all events, in view of our reiterated protest against this line of cross-examination and purposeless stuffing of the record that results therefrom.

Mr. Westall: We should like to have the record show that the witness has after each one of these questions concerning this particular point hesitated and has taken a long time to answer each question, showing that he is reluctant to testify concerning this point for some reason or other.

Mr. Blakeslee: We deny the statement. In point of fact, the witness, we assert, has not hesitated. He has taken possibly a reasonable time to frame his answer, and that can only be to the advantage of the defendant, particularly in view of the fact that the witness has testified that he has never made any full examination of this blueprint. If counsel wishes to make any such statement he should keep his watch out and make the record

show just what the delays are. We assert that the witness has not delayed his answers materially in any case.

A. I am unable and am unwilling to make any statements with regard to reasonable conclusions or anything of that sort. If I am confronted with a straight mechanical proposition I can answer it definitely and immediately. But I will go no further in regard to what this lug or point at "A" is, due to the fact that I do not know.

XQ. 125. By Mr. Westall: What do you understand is shown by the dotted rectangle in the center of the dotted portion of the drawing closely adjacent to the figures "43" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1?"

A. It is difficult to state what that is, due to the fact that it is probably an effort to show one of the ports either in the cylinder or casing, and there being several of these, it is difficult to say whether it is an effort to show a port or opening, or what it is. Parts of the blueprint are not complete with regard to the dotted lines, or it would show all of the openings in both sides of the casing, as well as that in the valve.

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XQ. 126. You have stated in your direct testimony that there was in the Power Development Company plant at the time you were there no automatic device for regulating speed or maintaining constant speed of the water wheels or for preventing dangerous inertia effects to the pipe line. I will ask you why, if you know, were not some of the modern forms of automatic gover-

nors employed at the Power Development Company plant at that time?

Mr. Blakeslee: Objected to as placing an arbitrary construction on the testimony.

A. I believe I testified that there were certain devices there for the prevention of inertia effects in the pipe line, being the hydraulically operated relief valve outside of the plant, and the air cylinder. Otherwise there was no device. The question I had taken up several times with Mr. Dearth who was superintendent there, and under whom I was employed, and he said that a large number of devices and arrangements had been tried out on the plant and all proved unsuccessful to such an extent that he believed that there never would be a successful governing device for a hydro-electric plant, and consequently they did not have any device on the plant at that time.

XQ. 127. By Mr. Westall: Was your understanding of the sole reason that they were not equipped with any of the modern forms of governor that the company had become so disgusted in their efforts to get some form of governor, that they had ceased to make any efforts to get a governor?

Mr. Blakeslee: Objected to as calling for a conclusion of the witness, not a statement of facts, and not the proper method of proof.

A. That was the idea Mr. Dearth conveyed.

XQ. 128. By Mr. Westall: From your knowledge of water-wheel governing would you say that some form of automatic governing was needed as much at the plant of the Power Development Company at the mouth

of the Kern River Canyon near Bakersfield, about which you have testified, as at any other plant?

A. Yes, sir—no, not as much as in some cases, due to the fact that the plant was small and two men could cover the plant and handle it in most instances in case of sudden changes in load without serious interruption of the service at Bakersfield.

XQ. 129. And so you thought that the fact that the plant was small might have been one of the reasons why no automatic form of governor was used, and that that fact, also taken in conjunction with any possible discouragement which you speak of might have prevented the installation of a modern form of governor. Is that correct?

Mr. Blakeslee: The same objection.

A. The fact that the plant could be handled manually was its only reason for existence at the time I was there, because if it had been unable to be controlled through manual means the service it would render would have been such that they could not have used the hydro-electric system, and it would have been necessary to support a steam plant to supply Bakersfield with power and light. However, it was possible to control the plant under ordinary conditions by manual means, and, therefore, it was not absolutely necessary to the existence of the plant to place governors upon it.

XQ. 130. By Mr. Westall: So, if I understand you correctly, the only reasons that you can give for the failure to install some of the modern forms of governors in the plant of the Power Development Company near Bakersfield at the time you have testified to, was, first

that the management or owners had lost faith in governors as a whole, and, second, that there was not so much need in the plant for a governor because it was small and because the manually operated means were sufficient. Is that correct?

Mr. Blakeslee: The same objection.

A. I do not agree with the statement that manually operated means were sufficient. We were able by being absolutely on the job to manage the plant under the average circumstances. However, at times very bad service was rendered in Bakersfield, due to the fact that the load changes were beyond our control and it was necessary to shut down the plant and start over, seriously interrupting service at Bakersfield.

XQ. 131. By Mr. Westall: So the service at Bakersfield was not governed in any way except with these manual means. Is that correct, according to your understanding?

A. Yes, sir.

XQ. 132. And that if for any reason a man was not present to manually operate these manual means, poor service at Bakersfield would result. Is that correct?

A. Unless strict attention was paid to the plant at all times we were very liable to have very poor service in Bakersfield, due to the variations of load at the plant. And there were many conditions that might arise, for instance sticks blocking the nozzle of one of the exciters, would cause as serious a shut down as we could get.

XQ. 133. Did you ever have any such accident happen as you have just referred to?

A. Yes; about three times while I was on the plant.

XQ. 134. You say sticks coming into what part of the machinery?

A. Into the nozzle block in the water wheel supplying the field exciting generators. These nozzles, of course, were small, and a stick would plug that, which, of course, would reduce the voltage on the field circuit, and that would immediately take the load off of the big generators and allow the plant to run away unless it was shut down immediately.

XQ. 135. And with respect to the load variations on that Bakersfield plant, did they compare in their extreme fluctuations with those of other hydro-electric plants with which you have been acquainted? In other words, was there just as much need at that time by reason of the extreme fluctuations of load for an automatic form of governor as there is a hydro-electric plants generally?

A. No. This governing action was in a small part taken care of by the fly-wheel effect afforded by the fly-wheels on the shafts of the water wheel and generators. This fly-wheel afforded a time lag for any change in the speed of the machine sufficient to allow us to get to the controlling means and take care of it. That is, in case of a sudden overload we would be able to go to these wheels and open up more water onto the wheels before sufficient slowing had been effected to cause the generators to fall out of step; and in case of a decrease of load the fly-wheels would carry the speed of the generators so that we would be able to shut them down before a serious speed had been attained.

Mr. Blakeslee: We move to strike out the answer as

not responsive to the question, the question apparently calling for fluctuations of load upon the generators and extent of the variations.

XQ. 136. By Mr. Westall: Is it not a fact that the plant known as the Crane Valley plant and the Bakersfield steam plant is connected with the plant at the Power Development Company so that they work together synchronously, and that the Power Development Company plant about which you have testified had less need for an automatic governor because it was governed through one of these other plants with which it was working?

A. No, sir; at the time I was working at that plant the plant was not connected up synchronously with any other plant. The Bakersfield steam plant had not been erected at that time, and a small line was run up to the Edison Kern River plant, but this simply supplied power for crushers, till they got their plant in operation.

XQ. 137. Do you mean to say that there was no plant at that time that this plant, about which you have been testifying, was connected synchronously with or which assisted in its governing in any way?

A. Not generating plant.

XQ. 138. Any plant?

A. I testified that it was synchronously connected with a rotary converter which supplied direct current for an electric railway system and a synchronous motor for the flouring mill in the city of Bakersfield.

XQ. 139. It is usual, is it not, to provide some means for manually shutting off the flow of water to the water wheel or for manually operating the gates even in

plants where the most modern form of automatic governors are installed?

Mr. Blakeslee: Objected to as indefinite with respect to the use of the word "gates."

A. Yes, sir.

XQ. 140. By Mr. Westall: Can you give any reason why this manually operated means are provided even when the best forms of governors are used?

Mr. Blakeslee: The same objection.

A. So as to permit of starting and stopping of different generators as they are required on the line, and so as to permit shutting the water off so that nozzle blocks may be repaired or repairs of the wheel or wheel casing made.

XQ. 141. By Mr. Westall: Or in case of any breakage or failure of a governor to properly perform its functions, the water might be controlled by manual means? Is that true?

A. Yes; in the case of a failure of the governor it could be shut down by the gate valve.

XQ. 142. You have testified concerning a certain air chamber which you say was connected with the plant of the Power Development Company on the pipe line outside of the power house at the Power Development Company plant near Bakersfield. What did you understand to be the purpose and effect of such an air chamber?

A. This air chamber was kept filled with an air bubble whose elasticity would tend to absorb any of the smaller tendencies of the water in the pipe line to cause

a water hammer by any sudden change of the controlling gates at the water wheel.

XQ. 143. And this air chamber had no effect of any kind in governing the water wheel, but was simply there to protect the pipe line from dangerous effects of the water. Is that true?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts, not the proper method of proof.

A. I believe that is correct. I do not know of any action in governing that the air chamber could possible have performed. The only use for it that was ever explained to me or that I ever figured out was in regard to the inertia effect of the water column.

XQ. 144. By Mr. Westall: And such a device might properly be used on any plant, no matter what kind of a governor was employed if those installing the plant desired to have any additional protection to the pipe line. Is that correct?

A. Yes, sir; I think so.

XQ. 145. In other words, if the engineer having the designing or having in charge the installation of the machinery wished to adopt all possible means for protecting the pipe line, even with the installation of the best known modern form of governor, he might still use an air chamber connected to the pipeline in substantially the same manner and for the same purpose as that at Bakersfield. Is that not correct?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not for a statement of

facts, and as merely argumentative and not the proper method of proof.

A. Yes, sir.

XQ. 146. By Mr. Westall: Now, at the time at which you were at the Power Development Company plant as testified by you on your direct examination, was that plant connected synchronously with any other plant to which it might be governed in any degree?

A. Not as far as speed or power generated are concerned, no. The only control we had was through the rotary converter and the synchronous motor at the flouring mill.

XQ. 147. And did not that fact make less needful an automatic form of governor, or, in other words, would that not be one of the factors that might enter into the decision of those in charge of the plant not to install any form of automatic governor?

Mr. Blakeslee: The same objection.

A. No, I cannot see how that could have any effect on the governor action of the plant so far as the speed and power developed is concerned. It simply had an effect upon the power factor. That is, bringing the pressure and current wave more in step in the transmission line and increasing the efficiency of transmission over the power line.

XQ. 148. By Mr. Westall: So you would say that that synchronous connection had no effect whatever in assisting in the regulation or governing of the plant. Is that true?

A. That is correct.

XQ. 149. In answer to question 67 you stated that

a butterfly valve was "more easy to control than any gate valve." What kind of valves did you have in mind when you used the term "gate valve?"

A. A valve in which a gate slides in a plane at right angles to the axis of movement of the fluid passing through the valve. In the common gate valve this slide rests against ribs on the seat.

XQ. 150. What is known as the "needle valve" is generally used in connection with water wheels at the present time, is it not, to control the flow of water to the wheel or through a relief nozzle?

A. I have seen the needle valve used in the controlling of water passing to the wheel. For instance, in the Edison plant on the Kern River above the Bakersfield plant.

XQ. 151. Two of such needle valves are illustrated in "Complainant's Exhibit Wilson Sketch A," and marked respectively "water gate" and "by-pass valve", are they not?

A. Yes, sir.

XQ. 152. Would you call such needle valves as referred to in your last answer "gate valves" in your answer to question 67 heretofore quoted?

A. No, sir; the movement in controlling in case of the needle valve is parallel to the axis of the movement of the water. In fact, it is co-incident.

XQ. 153. Would you call an ordinary plug-cock valve a "gate valve" within the meaning of your answer to said question 67 heretofore quoted?

A. No, sir. The action in opening or closing a plug-

cock valve is rotary and not longitudinally as in the gate valve.

XQ. 154. Referring to "Complainant's Exhibit Wilson Sketch C," please state whether you would consider the name "plug-cock valve" a proper descriptive term of the valve shown and marked "by-pass valve" in such drawing or sketch.

A. Yes, sir.

XQ. 155. Will you please describe this plug-cock valve illustrated in "Complainant's Exhibit Wilson Sketch C," describing particularly how it is supported within its casing and with what parts it comes in frictional contact?

A. This valve consists of a cylinder through which is an aperture in a diametral line. This cylinder is supported in a housing in which there is an opening to the cylinder and directly opposite an outlet from the cylinder, and in which opening or closing of the passage may be effected by rotating the cylinder so that its diametral opening registers with the casing openings, or it can be closed by so rotating the valve that the diametral opening is more or less at right angles to the casing opening. The cylinder bears against the sides of the casing surrounding it.

XQ. 156. Suppose that the plug-cock valve illustrated in "Complainant's Exhibit Wilson Sketch C" were not connected in any way with the water gate, but being substantially in the same location and for the same purpose, was operated manually independent of the water gates. Would you say that such a valve would perform its purpose and object any the less sufficiently

than a butterfly valve would in the same position and for the same purpose and connected and operated in the same manner?

Mr. Blakeslee: Objected to as indefinite in not stating how a butterfly valve was to be connected.

A. The butterfly valve would operate more easily than the plug-cock valve, on account of the fact that the water pressures are more balanced against the two opposite sides of the butterfly valve when in partially open positions than is the case on the plug-cock valve, and also the fact that the plug-cock valve bears against the sides of the walls of the casing, or causing a varying friction which increases as closure is effected.

XQ. 157. By Mr. Westall: So that the only reason why such a valve would be more difficult of operation, in your opinion, is that there would be more friction between the plug and its casing to be overcome. Is that correct?

A. No. That and the fact that in the case of the plug-cock valve there is only one stream of water passing through the valve and reactions against the valve are unbalanced, while in the case of the butterfly valve there are two streams of water pass the valve when in partially open position, whose reactions against the valve are balanced one against the other.

XQ. 158. And do you not think that any slight theoretical differences, is such exist, between the amount of friction or force necessary to operate the two valves, is a matter of very small consequence as a factor in determining the desirability of one valve over another?

Mr. Blakeslee: Objected to as placing an arbitrary

construction on the previous testimony of the witness and calling for a conclusion on the part of the witness and not for a statement of facts, not the proper method of proof, and being merely argumentative.

A. That is a matter which depends entirely on the head which is to be handled. In the case of low heads the reactions of the stream of water passing around a curved path are not serious. But as the head is increased the pressure exerted increases very much more rapidly, and the medium or high heads become a very important factor. The Bakersfield Power, Transit & Light plant had a head of about 220 feet, and the reactions on these streams were so great that we had a fire hose with a 1-inch nozzle that one man could hardly hold the nozzle when the full head of water was turned on.

XQ. 159. By Mr. Westall: Assuming that the plug in the by-pass valve illustrated in "Defendant's Exhibit Berry Blueprint No. 1" is supported by and rotates upon a shaft or at the point opposite its connection with its operating shaft, it is supported and rotates on a trunnion, and that the plug does not contact so as to cause any appreciable friction with its casing or housing, would you say that this valve would be any more difficult of operation than an ordinary butterfly valve located in the same position and for the same purpose?

Mr. Blakeslee: Objected to as not stating a mere hypothesis, but as being predicated upon conclusions with respect to the exhibit in question not borne out by the previous testimony of the witness or by the manifest disclosure of such exhibit, in that respect being misleading and placing an unwarranted interpretation upon the

exhibit in question, and as argumentative, without foundation, and calling for an impossible answer, and for these reasons not the proper method of proof.

A. Yes, sir; it would be more difficult of operation, depending on the power necessary to cause the stream passing through the by-pass valve to take a zig-zag course.

XQ. 160. By Mr. Westall: How much water is usually in the penstock or pipe line at the point just above the by-pass valve shown in "Defendant's Exhibit Berry Blueprint No. 1" in Fig. 4?

Mr. Blakeslee: Objected to as indefinite.

A. The pipe is full of water.

XQ. 161. By Mr. Westall: Suppose a butterfly valve placed in the by-pass illustrated in Fig 4 of "Defendant's Exhibit Berry Blueprint No. 1," and supported by a like shaft located in the same position as that shown in Figs. 2 and 4 of said "Defendant's Exhibit Berry Blueprint No. 1," please state whether or not it is a fact that if such butterfly valve is closed, it necessarily has to support on its bearings such weight or such water pressure as would the plug-cock valve disclosed in said exhibit?

Mr. Blakeslee: Objected to as assuming facts contrary to the testimony of the witness and the showing of the exhibit, with particular respect to the shafts mentioned, and calling for a conclusion.

A. Yes, sir.

XQ. 162. By Mr. Westall: And there would be absolutely no difference in the amount of friction it would be necessary to initially overcome between that

butterfly valve and a plug-cock valve constructed as I have before described, so that its plug does not come in frictional contact with its casing to any appreciable degree, and supported by a shaft or trunnion upon which it rotates?

A. That type of valve consisting of a cylinder supported on a trunnion is not a plug-cock valve, as I understand the term. The common illustration of a plug-cock valve is that used in a house hydrant in which the plug is slightly tapered and fits against the walls of the casing, the taper being for the purpose of taking up wear and keeping the valve tight.

XQ. 163. You can go on and answer the question.

Mr. Blakeslee: It is assumed that the question has been answered.

A. (Question having been read by the Examiner.) Not that I can see, in case of a cylindrical valve where the cylinder travels free of the casing.

XQ. 164. By Mr. Westall: And if a butterfly valve in the position and for the purpose described in the immediately preceding questions was closed, it would require just as great an amount of force for its initial movement as it would for the initial movement of the rotating valve heretofore referred to?

Mr. Blakeslee: The same objection.

A. The initial pressure, yes.

XQ. 165. By Mr. Westall: With a plug-cock valve or a rotating valve, whichever is the proper term, such as illustrated in "Defendant's Exhibit Berry Blueprint No. 1," or in "Complainant's Exhibit Wilson Sketch C," pivoted by a shaft or trunnions at opposite ends

and constructed so as to rotate on those pivots, there would be no reason why the body or cylindrical portion of the plug should contact closely with the housing or casing, would there?

Mr. Blakeslee: Objected to as stating and calling for a conclusion, as merely argumentative, not calling for a statement of facts and not the proper method of proof.

A. Yes; to cause complete closure it would be necessary to have the body of the valve contact with the case.

XQ. 166. By Mr. Westall. But complete closure would not be necessary for the purpose and in the position described, would it?

Mr. Blakeslee: The same objection; and further, that it is assuming a description that is forced.

A. A small opening would leave an opportunity for sand and sticks to clog the valve if it remained in that position long without movement.

XQ. 167. By Mr. Westall: And do those valves usually remain in closed position long without movement, or in any position long without movement?

Mr. Blakeslee: Objected to as assuming facts not testified to by the witness, namely, that there is any such thing as the hypothetical valve outlined by the previous question.

A. I do not know. I never observed a power house where a by-pass valve was used.

XQ. 168. By Mr. Westall: And there would be just as much opportunity for twigs, grass and other foreign matters, to clog and impede the operation of the butterfly valve, especially at points near its operating shaft or pivotal connection with the pipe in which it was placed, would there not?

A. Yes; but, however, it would not affect the rotation of the valve so much because you would have the greater leverage against its opening or closing.

XQ. 169. Now, a butterfly valve would not close the by-pass so as to prevent all leakage, would it? In other words, there would always be some space between the pipe in which the butterfly valve was placed and the periphery of the valve, would there not?

A. It would seem so, yes. However, the butterfly valves on the Kern River plant seemed to close the water column very completely.

XQ. 170. Now, in case the plug or cylinder of the rotating valve disclosed in "Defendant's Exhibit Berry Blueprint No. 1," assuming that such plug is supported by and rotates upon a shaft or trunnion, should be found to be difficult of operation because of any friction or contact with the casing, it would be a most obvious remedy to remove this plug or cylinder and grind it down so that it would contact very little, if at all, with its casing? Would it not?

Mr. Blakeslee: Objected to as merely argumentative and as based upon a false interpretation of the blueprint in question, and not calling for a statement of facts and not the proper method of proof.

A. Yes, sir; providing the shaft and trunnions were sufficiently strong to withstand the pressure exerted against the cylinder.

XQ. 171. By Mr. Westall: And if such trunnions or shafts were used at all, it would certainly be logical to make them strong enough to support the cylinder. Otherwise there would be no reason for their use. Is not that correct?

Mr. Blakeslee: The same objection.

A. No; they might be used for convenience in assembling or machining or for some other reason for fixing them there.

XQ. 172. By Mr. Westall: The ordinary damper in a stovepipe is a good example of a butterfly valve, or, rather, a good illustration of such a valve?

A. Yes, sir.

XQ. 173. If the disc of such a damper were made exactly the same size as the pipe it would be very difficult to turn, would it not, if not impossible to place it in the pipe?

A. That depends entirely upon the smoothness of the inside of the pipe and of the edge of the damper, and as to how much clearance there would be.

XQ. 174. Suppose that the disc would be so large that there was practically no clearance?

A. It could be lubricated and caused to move freely.

XQ. 175. If there was no clearance between the edge or periphery of such disc and the pipe in which it was placed, but if that was exactly the same size, or perhaps slightly larger than the pipe in which it was attempted to be operated, it would be very difficult of operation, wouldn't it?

A. Yes; if it was slightly larger it could not be placed inside of the pipe.

XQ. 176. The most obvious remedy for such a failure to operate would be to make the disc smaller, would it not, so that it would fit into the pipe?

A. Yes.

XQ. 177. And the most obvious remedy for a rotat-

ing valve in "Defendant's Exhibit Berry Blueprint No. 1" shown in the by-pass, if it were found by reason of friction to be difficult to operate, would be to remove the plug and grind it down, wouldn't it, in exactly the same way that one would grind down or reduce the size of the disc in a butterfly valve which was a little too large or which fitted too snugly in the pipe?

A. Yes; however, there is this difference: In the case of the plug valve it may or may not be necessary to construct the shaft passing through the same sufficiently large to withstand the pressure exerted against it. However, in the case of the butterfly valve, in order that the valve be workable at all, it is necessary to have the shaft constructed sufficiently strong to support the valve against pressure at part or full closure against the head of the water. For if this were not done the shaft would be sheared off and the valve blown out along with the water column.

XQ. 178. You have never seen a plug-cock or rotating valve such as is illustrated either in "Complainant's Exhibit Wilson Sketch 2," or in "Defendant's Exhibit Berry Blueprint No. 1," in actual operation in any by-pass, have you? That is, in any by-pass connected with any water-wheel installation, have you?

A. No, sir.

XQ. 179. So that your explanation of how this valve may operate or how it may not operate is based upon theory rather than any actual experience with such a valve used for such a purpose and in such a location as that shown in the exhibits referred to in my last question?

A. Yes; based upon the knowledge of moving water columns that I have gained in operating a hydro-electric station.

XQ. 180. But so far as that particular type of valve is concerned, namely, the rotating or plug-cock valve, you have never had occasion to see such a valve in operation with a by-pass for which it is evidently designed and shown in "Defendant's Exhibit Berry Blueprint No. 1." Is that correct?

A. Yes; that is correct.

XQ. 181. You have described that certain manually operated butterfly valve as having been in use at the plant of the Power, Transit & Light Company. Please state when you first observed that valve.

A. It was in April or May, 1906.

XQ. 182. How long before that had it been installed in the plant referred to, if you know?

A. I saw the general equipment for that plant the first time in the summer of 1904, and to the best of my knowledge and belief it was in the same shape then, as far as the valves and water-control is concerned, as it was in 1906 when I went to work at the plant.

XQ. 183. So that it must have been selected some time prior to 1904. Is that correct?

A. Yes.

XQ. 184. You were not present when it was selected or when its installation was proposed, were you?

A. No, sir.

XQ. 185. Then when you say in answer to question 67 that the butterfly valve was provided for use at this plant because it was more easy to control than any other

valve, you are not speaking with any positive knowledge of the reasons that operated upon the minds of those who selected it, are you?

Mr. Blakeslee: Objected to as not being according to the testimony of the witness, which was that the butterfly valve was provided, which is a very different thing from "chosen." "Provided," as we take it, means "put into place." To "choose" involves selection over others.

A. No, sir; I have no way of knowing that outside of the statements made to me by Mr. Dearth and Mr. Carpenter.

Mr. Westall: In view of the last answer of the witness, we move that all testimony regarding the probable reason for the selection of such valve be stricken out as resting entirely on hearsay.

Mr. Blakeslee: We oppose the motion on the ground that an engineer may testify as to the manifest reason for providing anything for any duty, when he knows the condition which surrounded the provision or condition which it had to satisfy in service.

XQ. 186. By Mr. Westall: For all you know, from your own knowledge, apart from any hearsay, this butterfly form of valve may have been selected because it was cheaper than some other valve or because it was more easy to install at that particular place, might it not?

A. That might have been the reason. However, I know that it was more easily operated, as well.

XQ. 187. When you say it was more easily operated, you mean it was more easily operated than the gate valve that you referred to, for instance?

A. Yes.

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XQ. 188. When you say in answer to question 81 that the water pressure causes the valve marked "by-pass valve" in "Complainant's Exhibit Wilson Sketch C," to be pressed against its seat, you are presuming, are you not, that the plug of said valve is in frictional contact with its casing and is not supported or rotated on a shaft or trunnion designed to bear the water pressure and designed to take such friction?

Mr. Blakeslee: Objected to as involving an unnecessary and pointless hypothesis, namely, that there are any such trunnions to be considered, inasmuch as the testimony of the witness has not disclosed the provision of any such device, nor has the witness testified to the presence of any such device, and is placing, therefore, an arbitrary and unfounded conclusion upon the testimony of the witness and the disclosure of these sketches.

A. It is my understanding that the plug-cock valve bears against the casing, and I answered that question with that in mind.

XQ. 189. By Mr. Westall: And you are assuming that the drawing marked "Complainant's Exhibit Wilson Sketch C," was intended to illustrate a frictional contact of the plug of the by-pass valve with its casing, and that such plug was not supported upon any shaft or trunnion designed to relieve or take away any friction of the plug with its casing. Is that correct?

Mr. Blakeslee: The same objection, and it is particularly pointed out that the testimony of the witness shows this to be a plug-cock valve, and further shows that in the light of his knowledge as to such valves and

plug-cock valves a plug-cock valve does not have any such bearing, he having distinctly testified to that effect.

A. Yes, sir; that was my understanding of the valve when I testified in regard to that sketch, and is still my understanding of a plug-cock valve, so far as any that I have ever seen.

XQ. 190. By Mr. Westall: Have you ever seen a by-pass valve of the plug-cock type either having its plug supported or rotated upon a shaft or trunnions, the plug having no frictional contact with its casing, or a rotating valve having a plug without such supporting shafts or trunnions and being supported and in frictional contact with its casing, either of such forms of valves being of approximately the same size as that illustrated in "Defendant's Exhibit Berry Blueprint No. 1" as controlling the by-pass and being used for the same or for any analagous purpose.

Mr. Blakeslee: Objected to as being merely repetitious, because it has already been answered by the witness, and, furthermore, as placing a conclusion upon the disclosure of the blueprint in question with respect to the dimensions of whatever that blueprint is supposed to represent, and as assuming without warrant that there is any by-pass disclosed by said blueprint, and upon the objections last made.

A. No, sir; I have never seen any by-pass of either type wherein this cylindrical type of valve was used. I have seen rotating valves of similar sizes with what I believe this represents in valves of Corliss engines.

XQ. 191. By Mr. Westall: When you speak of ro-

tating valves in connection with Corliss engines in your last answer, what kind of valves do you mean?

A. It consists of a cylinder with suitable ports through the same which are made to register with the openings in the valve casing by the rotation of the valve on its axis, which action is controlled by a stem and a bell-crank on the ends of the same and in which the valve bears against the casing around it.

XQ. 192. In which the plug bears against the casing?

A. Yes, sir.

XQ. 193. Do they use those valves at the present time?

A. Yes, sir.

XQ. 194. Are such valves difficult of operation?

A. Yes, they are; they require rather a heavy valve mechanism to control them.

XQ. 195. The butterfly valve is well known and has long been well known in the art, has it not?

A. Yes, sir.

XQ. 196. And is your testimony in relation to the valve illustrated in "Defendant's Exhibit Berry Blueprint No. 1" based, to any extent, upon your knowledge of this Corliss engine valve which you say is used at the present day?

A. Yes, sir. That is one of the types of valves which I have had experience with, of the plug-cock type.

XQ. 197. Do you mean to say that the Corliss engine about which you have spoken is an inoperative device on account of any friction between the plug and the cas-

ing of the valve and to which you have referred as being contained in this engine?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and involving an arbitrary interpretation of the word "inoperative", and as not the proper method of proof.

A. No, sir; in my opinion the Corliss engine is a highly operative mechanism. This, of course, is due to the fact that these valves can be kept at all times perfectly lubricated and also has a very powerful mechanism to operate it.

XQ. 198. By Mr. Westall: You have referred to the devices illustrated in "Complainant's Exhibit Wilson's Sketch A" and "Wilson's Sketch B and C," as illustrating the "balanced valves." I will ask you to state briefly why the device shown in "Complainant's Exhibit Wilson's Sketch A" is, in your opinion, a balanced valve?

Mr. Blakeslee: The question is objected to inasmuch as it places a false interpretation upon the testimony of the witness with respect to the by-pass valve shown in "Complainant's Exhibit Wilson's Sketch C," which the witness has testified is not a balanced valve.

A. The needle valve shown in Sketch A is of a balanced type, due to the fact that at any positions except complete closure, the pressures due to the head of water causing the valve to open are balanced by the pressures causing it to close, and, consequently, the valve may be moved with freedom from the stresses of the head which it is controlling.

XQ. 199. By Mr. Westall: You have spoken of the device illustrated in "Complainant's Exhibit Wilson's

Sketch A'' as a "needle valve." It is a fact, is it not, that there are illustrated in this sketch two needle valves, one marked "water gate" and another marked "by-pass" valve? Is that not correct?

A. Yes, sir. However, I was speaking of the type of valve. Both are of the same type.

XQ. 200. When you stated that the device illustrated in "Complainant's Exhibit Wilson Sketch A" is a balanced valve, which of these valves did you refer to? The one marked "water gate" or the one marked "by-pass" valve?

A. I referred to the needle type of valve, to which both of them belong. Consequently, I referred, really, to both valves; that is, both the by-pass valve and the water-gate valve.

XQ. 201. And you mean to say, then, that both of these valves are balanced valves; is that true?

A. Yes, sir.

XQ. 202. Now, it is true, is it not, that the only warrant you have for calling these two valves "balanced valves" is because they are joined together by a rod or link, and that upon the opening of one the other is closed, and vice versa, and they cannot be independently moved? Is that true?

A. No; I was thinking of a single needle-valve in regard to being a balanced valve, because in any position of pressure opening or closing, outside of complete closure, pressure of the head is balanced both on the back and front of the valve, and consequently it can be moved with comparative ease, friction excepted, in changing its position.

XQ. 203. Do you mean to say that a single needle-valve operated manually for controlling a by-pass valve and disconnected in any manner with the water gate, in other words, used as you have described in your testimony the use of the butterfly valve at the Power, Transit & Light Company plant at Bakersfield is a balanced valve?

Mr. Blakeslee: Objected to as indefinite.

A. Very nearly balanced. There is a slight difference in head due to the velocity action of the water passing around the valve. However, the valve is very nearly balanced.

XQ. 204. By Mr. Westall: Is it not a fact that the pressure of the water when the valve is closed or nearly so would prevent the valve from being moved backward in order to allow an opening? In other words, must not the complete weight of the pressure of water upon such a valve be overcome before such valve can be moved to open position?

Mr. Blakeslee: Objected to as indefinite.

A. As I stated above, the valve is not balanced when it is completely closed. It requires a certain pressure to start it to open position, but, as soon as a slight opening is effected, it then becomes balanced and the rest of the opening is a balanced action.

XQ. 205. By Mr. Westall: Will you please explain how when the valve is partly opened the water acts and assists in the further opening of the valve, and, therefore, makes this form of valve a balanced valve?

Mr. Blakeslee: All this line of questioning is objected to as not proper rebuttal cross-examination, and this ob-

jection applies to this whole line of testimony as so far developed, on the ground that the defendant's witnesses have testified uniformly with respect to the alleged bypass valve under consideration, namely, that attempted to be operated at the Power Development Company plant at the mouth of the Kern River as plug-cock valves, and the defendant is therefore estopped from showing what other types of valves might have been used or distinguishing between that valve and such other valves as might have been used, for the purpose of proving or disproving any of the issues of this case. This objection will be understood as repeated to any further questions along this line, which will, for that reason, needlessly encumber the record.

A. When the valve is partially open the needle part being completely submerged with water passing through the nozzle, and there being sufficient cross-sectional area between the outside of the needle valve itself and the nozzle casing, other than at the annular ring forming the nozzle, to permit a free flow of water, it is manifest that the entire needle valve head is subject to an equal pressure on all sides, and consequently the pressure from in front of the valve balances that in the rear, and there is no tendency to displace the valve.

XQ. 206. By Mr. Westall: Do you mean to say that the water pressing on the rear of the rounded portion of the head of the needle valve from the direction of the source of supply of the water is equal to the pressure from the front of the needle and pressing the needle backward toward the source of supply of the water?

A. Yes, sir.

XQ. 207. And that while water is escaping through this valve it presses equally backward upon the needle and that it presses with as much force backward upon the needle near its point as it does from behind the needle? Is that true?

A. Yes, sir.

XQ. 208. And is it also true, in your opinion, that the water presses back upon the needle after it has left the point of the nozzle?

A. Yes, sir. This is due to the fact that when the needle is properly designed, that is, the curve of reduction of the needle from the point of largest diameter forward in the stream is properly cleared, the reaction of the water flowing down over that curved surface is so designed as to balance any reduction of pressure from the point of the needle on forward.

XQ. 209. And that pressure upon the point of that needle is equal to the pressure from behind the needle?

Mr. Blakeslee: Objected to as indefinite.

A. Yes, sir.

XQ. 210. By Mr. Westall: Is it not a fact that there is more area of the needle back of its point of contact with the mouth of the nozzle than there is in front of this point?

Mr. Blakeslee: Objected to as indefinite and assuming that there is any single point of contact, and placing an arbitrary construction and an apparently incorrect interpretation upon the sketch in question.

A. Yes, sir. However, this is designed for the action of the water pressure.

XQ. 211. By Mr. Westall: Then, if that is true, in

order to compensate for the pressure upon the greater area at the rear of the needle, there must be a greater pressure backward of the water after it has left its nozzle, or while it is leaving its nozzle; is that true?—in order to compensate for the area at the rear of the nozzle?

A. No, sir. The pressure affecting the needle valve is that affecting the projected area taken along the axis of the stream of movement. That is, the pressure on that area of the needle beyond the point of largest diameter should equal that area on the projected area of the needle to the rear, which would be the same, with the exception of the area taken out by that of the stem diameter, which stem supports the needle. By increasing or decreasing the size of this stem a certain balance can always be effected. That is, a greater pressure can be made to come on the front of the valve than on the back by increasing the size of the stem where it passes out through the nozzle casing. For, supposing this stem was made equal to the largest diameter of the nozzle, the entire pressure on this valve would be backward.

XQ. 213. Then, in order to get the balance which you have spoken of, it would be necessary to increase the diameter of the stem upon which this needle is mounted, much larger proportionally than is shown in "Complainant's Exhibit Wilson Sketch A." Is that correct?

Mr. Blakeslee: Objected to as calling for a mere conclusion as to the degree and placing an arbitrary interpretation upon the disclosure of the sketch in question.

A. That is a matter of some refinement in design, and can only be calculated mathematically for the head,

the stem, the diameter in the opening and the amount of force required for the operation of the needle valve.

XQ. 213. By Mr. Westall: In order to obtain this balance in the needle valve illustrated by the portion marked "by-pass valve" in "Complainant's Exhibit Wilson's Sketch A," please state to what extent the water which has left the nozzle presses back upon the needle and aids in this balancing action. I mean to say, roughly, what proportion of this balancing is effected through the water which has left the nozzle.

Mr. Blakeslee: Objected to as calling for an arbitrary interpretation of the sketch and as also a conclusion as to matter of degree.

A. That is a very difficult thing to state offhand, because it can be made to vary to such a wide extent, in this way: the pressure depends upon the square of the velocity passing over the needle and upon the angle through which the water is caused to turn by the curve on the end of the needle valve. It is manifest that the velocity may be varied in different cases. That is, it is constant in any one case depending on the head of water to which the nozzle is subject. Also, the curve can be made to vary from any angle from 90 degrees down to almost zero.

XQ. 214. By Mr. Westall: Now, referring to "Complainant's Exhibit Wilson Sketch C," in which is attempted to be illustrated a plug-cock form of valve, which is marked on said exhibit "by-pass valve," is it your understanding that after the water passes through the port in the plug that it ^{re}passes back upon the plug in any manner and thereby balances the valve by a water pressure pressing back upon the plug?

A. Yes, sir. Of course, there is a certain reaction due to the nozzle form of the stream at this point. It certainly presses back with a certain amount of plain nozzle reactant pressure. However, as far as the pressure due to any curved action, as is effected in the needle valve, there is no such pressure in this case.

Mr. Westall: Cross-examination closed.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 215. Now, as to the reaction of the water leaving a plug-cock, such as indicated in "Complainant's Exhibit Wilson Sketch C," and labeled "by-pass valve" that is, the reaction upon the plug-cock valve fitting in its case, how does such reaction compare in stress with respect to the stress of the water impinging upon the plug-cock valve on the up-stream side?

A. The pressure of the water applied to the plug-cock valve on the up-stream side would be theoretically that which applies over the surfaces exposed by the part in the casing where the water is admitted to the plug cock, and that on the down-stream side is in the opposite direction and is equal to the pressure head multiplied by the cross-sectional area of the opening through which the water is passing. The difference between these two pressures is the pressure with which the plug cock is pressing against its seat in the casing. Thus, it is seen that the pressure on the casing is maximum when the plug-cock valve is closed, and this is reduced to zero when the valve is open, provided the opening in the casing at the point of admission is equal to the opening

through the plug and to the opening at the discharge point at the plug valve into the casing.

RDQ. 216. Now, with the plug-cock valve in the position shown in this "Wilson Sketch C," and assuming you were attempting to initiate movement of the plug-cock valve, what water pressure would you have on the plug-cock valve with respect to maximum or minimum?

A. Maximum pressure.

RDQ. 217. And, therefore, an attempt to move this valve to open it would be attended, or would it not, by the maximum water pressure considering all of the water pressure applied to the valve at that time?

A. It would.

RDQ. 218. Now, referring to "Berry Blueprint No. 1" and assuming, as you have testified, that there was a head of over 220 feet, if I remember correctly, in the pipe line back of the attempted by-pass valve at the Power Development Company plant in which this by-pass valve is supposed to have been installed, substantially what would be the pressure upon this plug-cock valve "41" shown in Fig. 4 of this exhibit, opposing initial opening of the plug-cock valve and following the dimensions indicated in this blueprint and the relation between the axial dimension of this valve and its diametrical dimension as judged by the dotted line shown in Fig. 2 of this blueprint?

A. This pressure would be that pressure exerted by a water column 220 feet on each square inch of the casing at the lower end of the head, which is about 92 pounds to the square inch, multiplied by the opening area in square inches. So the opening area which is

closed by the valve above point "44" of Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" in square inches, multiplied by 92 pounds, will give the total pressure operating upon the valve.

RDQ. 219. Now, assuming that the area so acted upon was substantially 90 square inches. What would this pressure amount to in this valve?

A. 8280 pounds.

RDQ. 220. And in tons, how many?

A. About 4 1-8.

RDQ. 221. And can you say roughly what amount of force would be required to thus initially rock this plug-cock valve to bring it to a position of commencement of opening under such pressure, calculating by the showing in Fig. 4 of this blueprint and assuming that the part marked "40" connects with the crank-arm on the end of an operating shaft shown in dotted lines leading to the center indication "42".

A. This shows a length of operating arm equal to the radius of the cylinder of the plug-cock valve, and, therefore the pressure necessary to move the valve would be 8280 pounds multiplied by the coefficient of friction of the surfaces in contact. That is, the kind of metal or material the valve is composed of and that of the casing against which it rubs.

RDQ. 222. Do you know of any speed-sensitive governor device which, upon such calculations, would have a working capacity to rock such plug-cock valve under the conditions of pressure named so as to produce a sensitive response to governing action?

A. One could be constructed, of course, strong

enough to develop almost any power, provided it is constructed large enough.

RDQ. 223. And the larger you make such governor, is it true, or is it not, that you have a larger inertia factor which, in turn, affects the sensitive responsiveness of the governor itself to the governor mechanism?

A. Yes, sir; that is correct.

RDQ. 224. Now, with respect to the valve marked "by-pass valve" in "Complainant's Exhibit Wilson's Sketch B," is there any corresponding variation between maximum and minimum pressures of water upon this valve incident to the movement of the same?

A. Very little, if any. The actions are almost perfectly balanced in the butterfly valve.

RDQ. 225. And how in the same respects is it in consideration of the needle valve marked "water gate" and "by-pass valve" in "Complainant's Exhibit Wilson's Sketch A?"

A. If these valves are properly designed there is almost perfectly balanced action.

RDQ. 226. And is it proper to say that a plug-cock valve such as that shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" is "closed" in any position it assumes which interrupts theoretically or entirely the passage of water through the plug cock?

A. Yes, sir.

RDQ. 227. In the steam engine plug-cock valves you have spoken of, what have you to say in comparison of the ordinary steam pressure behind the same and the pressure upon the same type of valve of the same size incident to the application of a column of water with a head of over 220 feet?

A. The pressures usual in a Corliss engine are considerably in excess of that of a water head represented by 220 feet of water column. However, the opening of the valve is very much smaller, due to the fact that steam velocities are very much in excess of the velocity represented by water under the same pressure.

RDQ. 228. And what is the result of the effect on the balanced condition of the valve?

A. The size of the opening in the valve is very much smaller in handling steam than would be necessary for handling water power under similar conditions. The valve of the Corliss engine is still unbalanced. However, this valve is not used for governing; it is simply used for the purpose of admitting steam to the cylinder at the proper times, and also other valves are located below these cylinders for the purpose of permitting steam to pass out of the cylinders at the point of exhaustion.

RDQ. 229. Then, as I understand it, the tortion of the plug cock which is exposed to the steam pressure in its case is relatively small because of this relatively small port used in the plug cock?

A. Yes, sir.

RDQ. 230. And what is the result, therefore, as to the area exposed to pressure in a steam engine in comparison with the area exposed to pressure in a hydraulic plug cock such as disclosed in "Complainant's Exhibit Berry Blueprint No. 1" Fig. 4.

A. The area exposed to permit the passage of the same amount of power would be very much larger in the case of the water installation than in the case of the steam engine, due to the fact that the steam velocities

are very much higher than those of water under the same pressures, and, consequently, very much greater power will pass through an aperture of a given size for steam than for water.

RDQ. 231. And this steam at the same pressure as water in the same comparison, how will the total pressure upon the two valves opposing movement of the valves compare?

A. That depends upon the size of the valve.

RDQ. 232. Assume the valves were of the same size and consider the variation in superficial area of the valves upon which the steam and water respectively impinge, how will the pressures compare, namely, those which act upon the two valves, to oppose their turning?

A. The pressure exerted upon closing the valves and pressing against their seats would be the same. However, in the case of steam a much better lubrication is afforded, and, therefore, the coefficient of friction exists which allows a much smaller power to be used to move the valve in the case of steam than in the case of water.

RDQ. 233. Assume that less of the valve is exposed in steam powers than is exposed in water powers, what would be the relation of the pressures?

A. The variation in the pressure on a certain valve, providing the conditions remain the same, vary according to the area exposed. That is, the pressure reduces as the size of the valve is reduced.

RDQ. 234. Then if in two valves, one a steam valve and one a water valve of the plug-cock type, of the same size, there is less plug-cock area exposed for application of steam pressure than there is for the application

of water pressure, and the fluid pressures are the same, in which valve will there be the greatest total pressure opposing turning of the plug cock?

A. As I understand your question, the size refers to the horse-power transmitted through the valve ?

RDQ. 235. I am referring now to the size of the plug cock en mass.

A. Linear dimensions?

RDQ. 236. Yes. Diameter and axil length. I am referring to the size of the valves and supposing that they are of the same axil length and diameter.

A. The water valve.

RDQ. 237. And it is the practice in such steam valves to have relatively less of a valve surface exposed to the direct steam pressure?

A. Usually the valve is made smaller in linear dimensions.

RDQ. 238. And how does that affect the question of frictional existence?

A. The friction and resistance remain about the same, providing the area exposed to the pressure is the same.

RDQ. 239. But if the steam valve is made smaller relatively, what pressure change will there be if any?

A. There will be no pressure change provided the port area is left the same.

RDQ. 240. But if the port area is less than the port area in the hydraulic valve, how will the pressure compare?

A. The pressure will be very much less in the steam valve than in the hydraulic valve.

RDQ. 241. So that even if a greater steam pressure than water pressure is had, the proper passage of the steam might be effected with less pressure-producing friction in the steam valve than in the water valve. Is that correct?

A. Yes, providing the steam pressure is not very greatly in excess of the water pressure.

RDQ. 242. And in these steam valves is or is not considerable mechanical force required to actuate the same?

A. Yes; considerable force is necessary to operate the valve.

RDQ. 243. Now, in the installation of a plug-cock valve for hydraulic purposes such as that under discussion, and shown in "Berry Blueprint No. 1" Fig. 4, is it in usual practice, or any practice known to you, expedient to provide lubrication between the co-acting plug-cock and casing surfaces?

A. No, sir. The only means of lubrication possible in this case is to make the plug cock and casing of such material as will naturally lubricate themselves. Because any lubrication in the form of a separate lubricant applied to those parts would be immediately washed away by the water.

RDQ. 244. Therefore, how do the possibilities of lubricating such hydraulic plug-cock valve compare with the possibilities of lubricating such steam plug-cock valve as to efficiency or lubrication?

A. It is difficult to lubricate surfaces under water, while in the steam powers it is customary to apply the cylinder oil to the steam pipe passing to the plug-cock

valves in the cylinder, and, consequently, the steam carries the lubrication with it for lubricating the parts.

RDQ. 245. As to a body of predetermined shape or mass emersed in a stream, leaving out of consideration the frictional factor, what have you to say with respect to the comparison of the back pressure upon such body and the forward pressure thereupon?

A. If the area through which the stream passes around the body is sufficiently large so as to prevent serious pressure reduction on each side of the body, the only tendency to move that body is that of any friction of the fluid passing over the body.

RDQ. 246. And in needle valves of the type shown in "Complainant's Exhibit Sketch A," is it or is it not customary to take into account the conformation of the mass of the needle head in order to produce this balanced relation?

A. In the design of a needle valve it is almost necessary to take this factor into account and also all the other factors entering into any action upon the valve, because the design of a needle valve is one of a very delicate mathematical nature.

RDQ. 247. Now, is it possible to add to the diameter of the stem of a needle valve so that the back- or upstream pressure upon the needle valve is greater than the forward or down-stream pressure?

A. Yes, sir.

RDQ. 248. And by thus varying such stem dimensions is it or is it not possible to predetermine the status of balance of such needle valve?

A. It is.

RDQ. 249. Then your conception of the mechanical definition of a plug-cock valve, if such valve is not in intimate rubbing contact with its casing, is or is it not a plug-cock valve?

Mr. Westall: Objected to as having been fully covered, incompetent, irrelevant and immaterial, and not proper redirect examination.

A. So far as I can remember, the only types of plug-cock valve that I know of have a plug in intimate contact with the casing.

RDQ. 250. By Mr. Blakeslee: And, therefore, if the plug is not in intimate contact with the casing and is carried on end bearings, is it or not a plug-cock valve?

A. I should say that it was not a plug-cock valve.

RDQ. 251. Now, as ~~between~~^{for} two plug-cock valves of the same capacity, one ~~of~~ steam practice and the other for water practice, which, if either, would be subjected to the greater frictional resistance to rotation?

A. The valve whose product of pressure and coefficient of friction is the greatest would have the greatest frictional resistance.

RDQ. 252. And how would that work out as between the two such plug-cock valves of the same capacity of pressure fluid to control?

A. The frictional resistance would be much greater in the case of the hydraulic valve.

RDQ. 253. If a rotating valve mounted in its case so that it has its contact within the case, and an interspace exists between it and its case, what have you to say with respect to any tendency of the valve to sub-

clear or clean itself of grass, twigs, or other inter-lodging obstructions, in comparison with the same qualities of a butterfly valve?

Mr. Westall: The same objection.

A. The cylindrical type of valve mentioned in the question would not clear itself of obstructing particles or material as would the butterfly valve, due to the fact that the surface exposed to the cylindrical valve has more of a tendency to grind the particles of material back and forth without clearing the confined space, while in the butterfly valve this condition exists only at a very small point or area adjacent to the axis of rotation.

RDQ. 254. By Mr. Blakeslee: In your previous testimony, under cross-examination, when you referred to a "gate valve," in what sense did you mean us to understand your use of the term? Or give us a definition of your conception of a gate valve as such.

A. The term "gate valve" is applied to that type of valve wherein a disc or plane surface is slid in the plane perpendicular to axis of movement of the fluid controlled.

RDQ. 255. Referring to the air chamber which you have mentioned as being on the pipe line of the Power Transit & Light Company plant, or Power Development Company plant, outside of the power house, what was the action of the air bubble in the same after it had once yielded to a shock of inertia effect in the pipe line?

A. In the case of a shock in the pipe line caused from a sudden closure or partial closure of the water nozzle, the bubble is compressed; as soon as the shock is absorbed, that is, if the shock comes within the range of

the air cylinder, the increased pressure causes a retardation slightly of the velocity of the entire water column, slightly in excess of that necessary to maintain the pressure at the lower end of the pipe, and on the air bubble, with the opening at that time exposed in the way of the nozzle. Its deficiency of water is then supplied by the expansion of the air bubble until it gradually regains its original size. Or it may go beyond this point slightly and drop back and forth until an equilibrium was again established.

RDQ. 256. Does this air bubble in this air chamber, therefore, prevent inertia stresses in the pipe line or penstock, or merely act in an alleviating nature with respect to the same when produced?

A. The air bubble reduces the range of pressure affecting the pipe line which would be caused by any given shock under that which would exist were the air bubble not present.

RDQ. 257. Is it or is it not necessary for the shock in the pipe line first to occur before the air bubble in the air chamber can act to affect the same?

A. It is necessary to have a shock in the pipe line in order to bring the air bubble into action.

RDQ. 258. Now, in the use of a positive vent upon the pipe line to permit actual escape of water when any tendency toward shock-production in the pipe line occurs, is it or is it not possible by the provision of such vent, such as that controlled by a by-pass, to prevent such shock?

A. The usual cause of shock in a pipe line is due to the more or less sudden opening or closing of the nozzle

area. The effect of a by-pass when properly constructed and designed is to be able to keep this nozzle area constant for the entire lower end of the pipe line. That is in case of a reduction in power by governor action closing the nozzle wherein the water is applied to the wheel, a corresponding increase in the opening of the by-pass maintaining the total nozzle area constant will avoid tendency to shock the pipe line.

RDQ. 259. Then do I or do I not understand you correctly when I deduce from your testimony that in the use of the air-chamber and the air-bubble a shock first occurs in the pipe line and then is attempted to be modified by the air bubble, whereas in the use of the by-pass device a shock is anticipated or prevented?

A. That is my understanding of it; yes, sir.

RDQ. 260. And in the use of such an air bubble, is there or is there not always a rebound with a succeeding shock in the pipe line?

A. Yes; to a smaller degree than the original shock there is a rebound. In cases of rather severe shock, there is a series of these gradually diminishing shocks.

RDQ. 261. Now, with respect to even inexpensive and satisfactory governing, what have you to say with respect to the results obtained at the Power Development Company's plant, incident to hand governing, when you were there, in comparison with the results which might have been obtained at that plant had a modern automatic governor been employed?

A. If a modern automatic governor had been employed the services of three men might have been dispensed with, because it would have been very easy for

one man to control the entire plant without any of the assistants.

RDQ. 262. And how with respect to even and satisfactory governing?

A. The governing also would have been much more even and more satisfactory in the case of the automatic governor.

RDQ. 263. Were or were there not fluctuations of the load imposed upon the water wheels at this plant while you were there, which in central-station terms are proper to state as being great fluctuations?

Mr. Westall: Objected to as vague and indefinite.

A. There were great fluctuations imposed at times. However, it was rare in this plant. These fluctuations were due to the breaking of wires and breaking down of insulators and short-circuits on the line. As far as general load conditions were concerned, about the only fluctuation we noticed in the power outside of the gradual increase and decrease of the load at different times of the day, was due to the street car service in the city of Bakersfield.

RDQ. 264. By Mr. Blakeslee: A fluctuation in load due to street car service required, did it, or did it not, frequent repetitious hand governing of the plant?

A. No. We usually let the wheels take care of themselves, and the voltage and frequently varied as much as eight or ten per cent.

RDQ. 265. And how does such variation of voltage affect incandescent lamps installed upon such a circuit?

A. It is noticeable in the brilliancy of incandescent lights.

RDQ. 266. What effects are produced in this brilliancy?

A. Causing an increase or decrease in the brilliancy of the lights, due to variation in voltage.

RDQ. 267. Is such fluctuation or flickering of illumination of incandescent lamps considered a proper condition at the present day with modern governing apparatus controlling the generators?

A. It is desirable, of course, to avoid any flickering of the lights, if possible; and it is usually taken care of with the modern governors, and the size of the apparatus furnishing the power, together with the wires carrying the current to the point of consumption. So that in a well regulated plant no flickering can be observed.

RDQ. 268. Then the governing of that plant would not today be considered proper governing in these respects. Is that so, or is it not?

A. I think the service which was furnished by the Power, Transit & Light Company power house at that time would today be considered very poor. In fact, it was considered so at the time I was operating on the plant, particularly in the summer time when the amount of current consumed in lighting was small as compared with the motor load. The variation was quite noticeable.

RDQ. 269. That is, poor with respect to governing?

A. Yes, sir.

RDQ. 270. And would that governing likewise be today considered poor if there were other energy-consumers upon the circuit supplied with energy at that

plant which required evenness of voltage to maintain constant speed or constant performance of one nature or another?

A. In case of any such apparatus it would be necessary to put a voltage-regulator on the line supplying the particular piece of apparatus, in order to get a steady voltage.

RDQ. 271. And governing considered proper at the present time would obviate the necessity of such voltage-regulator, would it?

A. Yes, sir.

RDQ. 272. Referring to "Defendant's Exhibit Berry Blueprint No. 1," do you find any lengthwise or axial shaft of the plug-cock valve "41" indicated in the sectional view of Fig. 4?

A. No, sir.

RDQ. 273. If that were a true section transversely to the plug cock, would or would not such shaft show in section in this view?

A. The shaft would show in full line across that section in the view.

RDQ. 274. Referring to "Defendant's Exhibit XX," and to the parts generally designated as "J" therein, do you find any indication of any end bearing on any rotating valve included in those parts shown at the left-hand side of such parts "J"?

A. No, sir.

RDQ. 275. Referring to "Defendant's Exhibit Cobb Blueprint No. 1," do you find therein in the part marked "J" any indication of any axial shaft or of any end-bearing at the end of the part "J" opposite to that which is provided in the feature marked "K"?

A. No, sir.

RDQ. 276. Referring to "Defendant's Exhibit Berry Blueprint No. 1," and assuming that in Fig 2 the dotted line next to the figures "43" and the other dotted line beneath the same and next parallel to it, indicate the port through the plug cock, and do you find any indication of any axial shaft in such showing?

A. No, sir.

RDQ. 277. Referring to "Defendant's Exhibit Cobb Blueprint No. 1," do you find any indication shown in the part "J" thereof of any such axial shaft?

A. No, sir.

RDQ. 278. When you have stated that the nozzle block of the exciter water wheel of this Power, Transit & Light Company plant became plugged by any small stick or any small twigs or grass, or any other obstruction, was any inertia effect produced in the pipe line or penstock?

A. No, not noticeably, due to the fact that this nozzle was very small, being not more than an inch or an inch and a quarter in diameter, whereas the wheels are provided with nozzles of about 144 square inches nozzle area in the wheel, there being three of them, and there would be about 432 square inches if the plant is running to full capacity.

Mr. Blakeslee: That is all.

Mr. Westall: No recross.

July 8, 1915, P. M .

C. L. Cory, a witness heretofore produced and sworn on behalf of complainant, being recalled for further

testimony on behalf of complainant, testified as follows
in answer to questions by Mr. Blakeslee:

BY MR. BLAKESLEE:

Q. 531. You are the witness Cory who has previously testified for complainant in this case, are you not?

A. Yes, sir.

Q. 532. I believe you have previously testified in this case that you have familiarized yourself with the drawings, specifications and complete disclosures of Complainant's Exhibit A, being a copy of the Lyndon patent in suit; is that correct?

A. Yes, sir.

Q. 533. In your previous testimony you have discussed certain elements of a disclosure in said Lyndon patent referred to as the by-pass and by-pass valve therefor, and means for causing the by-pass valve to return to a certain position after it has moved in conjunction with the water-wheel gate inversely thereto. I will now ask you if you have familiarized yourself with "Defendant's Exhibit C. S. English Patent No. 521,088", which I now hand you?

A. Yes, sir, I have, and I believe that I understand it.

Q. 534. Do you or do you not find in the disclosures of the English patent the several features and elements which I mentioned in my last question?

A. No, I do not find the same elements.

Q. 535. Do you find any elements in any sense equivalent thereto?

A. No, I do not.

Q. 536. Have you familiarized yourself with the dis-

Further direct examination.

closures of "Defendant's Exhibit Wetmore Patent No. 519,597", which I now hand you?

MR. WESTALL: It is to be noted of record that in answering these questions the witness has before him a chart of some kind, to which he refers before making answer, and counsel for defendant objects to the use of any such chart unless it is identified and offered in evidence.

MR. BLAKESLEE: We do not believe the witness is depending upon any chart, whatever it may be, before him, and therefore we will ask the witness to answer the question without reference to any such chart.

THE WITNESS: Before answering the question, I desire to say that I am not, nor is it my intention, to utilize the chart in any way whatsoever in answering the question.

(The reporter here read Question No. 536.)

A. I have.

Q. 537. Do you find disclosed in that patent the particular features and elements which I have last referred to?

A. I do not.

Q. 538. Do you find disclosed in that patent anything in any sense the equivalent of any such element referred to?

A. I do not.

Q. 539. Have you familiarized yourself with the disclosures of Defendant's Exhibit Lombard Patent, No. 533,656, which I now hand you?

A. I have.

Q. 540. Do you find disclosed in that patent any by-pass device and valve therefor for passing around a

water-wheel any part of the water which otherwise would flow to the wheel, such by-pass being connected with a water-wheel gate and operated inversely thereto?

A. I do not.

Q. 541. Do you find anything in any sense equivalent to any such by-pass device and valve therefor?

A. No, sir, I do not.

Q. 542. I now show you Defendant's Exhibit Lamb patent, and ask you if you are familiar with the disclosures thereof?

A. I am familiar with the disclosures of the Lamb patent.

Q. 543. Do you find disclosed in any manner or place in that patent a by-pass device for passing around the wheel, so as not to engage the wheel, any portion of the water which otherwise would be passing to the wheel, with a valve device for such by-pass device?

A. I do not.

Q. 544. In your previous testimony you have discussed certain features of Complainant's Exhibit A (copy of Lyndon patent in suit), therein referred to as the returning device, and including the clutch members 22 and 23, the electro-magnet, 32 for operating the lever arm 24, to cause such clutch members to coengage, and the several connections between the clutch member 22 and the core 34 of the solenoid 33. Will you please now briefly state what effect the operation of this returning device has upon the change of position or condition of the water wheel gate or gates, in the operation of the governor?

A. I don't know that I am absolutely clear as to what

you mean by the general statement, the operation of the governor.

Q. 545. Well, kindly answer the question which is put, with the explanation which I now give, that by operation of the governor I mean the general performance of the governor apparatus disclosed in the patent in suit. What I wish to know is what part this returning device plays in the general operation of the governor and the movement of the water wheel gate or gates?

A. Well, the part played by the returning device in the operation of the governor upon the water-wheel gate is to prevent the water-wheel gate closing so rapidly as to overrun, or to cause what is generally known as hunting ~~for~~ the governor and a speed above, and then a speed below normal.

Q. 546. In this connection how with respect to the opening movement of the water-wheel gate?

A. The same is the effect of the returning device, preventing the opening of the water-wheel gate to proceed farther than is absolutely necessary for the changed conditions, and necessitates its being, after it has been opened, closed slightly to meet a balanced set of conditions.

Q. 547. In other words, how would you define the position to which the water-wheel gate is caused to be brought through the agency of this returning device?

A. The position that the water-wheel gate is brought to is its final and definite position for that particular condition of load.

Q. 548. Do I understand that you limit your observation to changes in load?

A. Changes in load, or a change of speed for any reason.

Q. 549. I now call your attention again to Defendant's Exhibit Lamb patent, and ask you if you find disclosed therein any agency, device or element which corresponds, in either construction or function, with this returning device of the Lyndon patent in suit, which we have just discussed?

A. No, I do not.

Q. 550. Do you find any element, device or agency disclosed in this Lamb patent, which in any sense is equivalent to such returning device?

A. I do not.

Q. 551. Similarly I call your attention to Defendant's Exhibit Wetmore patent, No. 519597 and ask you if you find disclosed therein any agency, element or device corresponding, in either construction or function, or performance, to this returning device of the Lyndon patent which we are discussing?

A. No, sir, I do not; no such device, or the equivalent thereof.

Q. 552. Similarly I call your attention to Defendant's Exhibit C. S. English patent, No. 521,085, and ask you if you find disclosed therein any agency, element or device corresponding, in either construction or function, to this returning device of the Lyndon patent which we are now discussing, or in any sense equivalent thereto?

A. I do not.

Q. 553. Similarly, I call your attention to Defendant's Exhibit Lombard Patent, No. 533656, and ask if you find therein any agency, element or device corre-

sponding, in either construction or function, with, or in any sense equivalent to, this returning device of the Lyndon patent which we are discussing?

A. No, sir, I do not.

Q. 554. I now call your attention to Defendant's Exhibit French Patent, and ask you if you have familiarized yourself with the disclosures thereof?

A. Yes, sir, I have.

Q. 555. Please state whether or not you find disclosed in Defendant's Exhibit French Patent any device, element or agency corresponding in either construction or function with or in any sense equivalent to this returning device of the Lyndon patent which we are discussing?

A. I do not.

Q. 556. Similarly I call your attention to Defendant's Exhibit Swiss Patent, and ask you if you have familiarized yourself with the disclosures thereof?

A. Yes, sir, I have.

Q. 557. Please state whether or not you find disclosed therein any device, agency or element corresponding in either construction or function with, or in any sense equivalent to this returning device of the Lyndon patent in suit which we have been discussing?

A. I do not.

Q. 558. I now show you Defendant's Exhibit Nozzle and Governor for North Star Mines, Grass Valley, California, September 3, 1898; Sheet 27, and ask you if you have familiarized yourself with the showing of this blueprint?

A. Yes, sir, I have.

Q. 559. Do you find disclosed in this blueprint any by-pass device, or any valve for such by-pass device, such as we have discussed ^{as being disclosed} in the Lyndon patent in suit, or any thing in anywise equivalent thereto?

A. I do not.

Q. 560. Furthermore, do you or do you not find disclosed in this blueprint any returning device such as disclosed in the Lyndon patent in suit, or anything in any wise equivalent thereto?

A. I do not.

Q. 561. I now call your attention to Defendant's Exhibit Berry Blueprint No. 1, and ask you if you have familiarized yourself with the disclosures thereof?

A. I have.

Q. 562. Do you find disclosed in this blueprint any device, agency or element which corresponds in either construction or function with, or in any sense is equivalent to the returning device of the Lyndon patent in suit which we have been discussing?

A. I do not.

Q. 563. Referring still further to this ^{present} patent blueprint, what is your understanding of the parts associated together in the blueprint and lettered 40, 41, 42, 43, 44 and 46?

A. My understanding of the parts mentioned in the question is that these parts taken together compose an operating mechanism for a rotating stopcock valve which may have its position changed to allow water to be by-passed around the water wheel itself; the position of this rotating stop-cock valve being dependent upon the operation of the crank shaft 49 connected with the con-

necting rod 40; this rotating stop-cock valve being mounted on a shaft 42 and supported upon one end by the bearing 41.

Q. 564. Does the part you refer to as the shaft 42 extend through the stop-cock you have referred to?

A. From the drawing I would infer that the shaft does extend through the rotating stop-cock valve, but having a bearing only upon one end.

565. Is this shaft shown in Figure 4 of this blueprint?

A. It is.

Q. 566. What nature of view do you make out this figure 4 to be, with respect to the stop-cock?

A. It is a sectional view.

Q. 567. Is the shaft you have referred to a sectional view?

A. It is not; it is shown dotted, or appearing behind the sectional view of the rotating stopcock valve.

Q. 568. Is it then indicated as passing through the stopcock valve, in this view?

A. No, it is not so indicated in view figure 4.

Q. 569. Please define a stop-cock valve as you have used the phrase?

A. The use of the adjective "stop-cock" is properly applied to this valve, as it is exactly similar to the so-called water-cock, or stop-cock, wherein a cylindrical valve, through which a hole is cut, is inserted concentric with the outer casing of the valve; the opening or closing of the valve being accomplished by rotating the inner portion of the valve closing it, and when the metal part of the internal cylinder closes the openings, and open-

ing the valve when the hole cuts through the stop-cock shaft is moved so as to make a free passage through the valve casing itself.

Q. 570. I notice that you have referred to a hole cut through the stop-cock shaft. Do you refer to the hole shown cut through the stop-cock body in figure 4?

A. Yes.

Q. 571. What is the nature of the engagement of the stop-cock body with the casing or housing within which it is turned?

A. Well, the stop-cock shaft, as I have used it, is inserted within the cylindrical casing of the valve, and the engagement is which might be called the fitting of the shaft part of the stop-cock valve into the concentric exterior casing.

Q. 572. Am I to understand, or am I not, that this stop-cock body, or shaft as you call it, turns in the casing?

A. Yes.

Q. 573. Slipped around it?

A. It must turn in the casing in order to be opened or closed, or increase the opening, or decrease the opening.

Q. 574. Do you find disclosed in this blueprint any other shaft than the body of the stop-cock to which you have referred, and pertaining to the mounting of this stop-cock?

A. I observe the shaft which carries the stop-cock body, which I think is a better word than stop-cock shaft, 42, in figure 4, and also 42 in figure 1.

Q. 575. By what means is the stop-cock body rotated?

A. The stop-cock body is rotated through the connecting rod 40 acting upon the crank shaft 49, outside of the valve casing.

Q. 576. Is that crank shaft, or is it not, the shaft you have referred to at the end of the stop-cock body?

A. It may be a part of the crank shaft, or it may be a part of the shaft upon which the stop-cock valve body is mounted it is not clear from the drawing, which.

Q. 577. By what is the frictional pressure of the turning stop-cock taken up in this blueprint disclosure?

A. There is nothing on the blueprint to indicate any method of compensating for the friction.

Q. 578. Between what parts does this friction exist?

A. The friction exists between the stop-cock body 41 and the casing 43.

Q. 579. Is there such a valve known to engineering as a plug-cock valve?

A. Yes, I think so.

Q. 580. How does that compare with the stop-cock valve you have testified about?

A. It is very similar to it in construction and operation.

Q. 581. Can you point out any difference?

A. The only difference that I can think of would be probably in the plug rotating valve that the rotating element would be tapered so that it might be tightened up by a screw on the lower side, and the wear taken up in that manner.

Q. 582. Is there, or is there not any difference between the plug-cock valve and the stop-cock valve with

respect to the frictional engagement of the body of the valve with the casing within which it turns?

A. No, there is none.

Q. 583. Does or does not this frictional engagement always occur in these types of valve?

A. The frictional engagement between the rotating element on the inside and the casing of the valve on the outside always exists in valves of this type.

Q. 584. I call your attention to what appears as a dotted line enlargement in Figure 2 of this blueprint before us, marked with the red letter and leading line A, and ask you if you find any indication of any such part or showing in Defendant's Exhibit XX, which I now put before you, in the part marked "J" therein?

A. No, I do not find any such on the part marked "J".

Q. 585. Do you or do you not find any indication from this blueprint before us of any of the friction existing between the stop-cock valve and its case being in any way compensated for by the shaft 42, or crank shaft from which extends the crank 49 and connecting rod 40?

A. No, I do not find any such.

Q. 586. Do you find in this blueprint before us any indication of any definite bearing or journal for such crank shaft or shaft 42?

A. No, sir, I do not.

Q. 587. Do you in this blueprint find any indication or disclosure of any adjunct or part for attachment of the plug-cock valve designed to take from or share with the plug-cock the frictional strain or resistance set up by engagement of the plug-cock with its case in rotation of the plug-cock?

A. No, sir, I do not.

Q. ⁵⁸⁸ Assuming water flowing through the pipe 46 to exert the pressure of the head in that pipe upon the plug-cock 41, what would be the effect of such pressure upon the turning of attempted turning of that plug-cock, responsive to any governing action, assuming that the blueprint discloses a water wheel to which water is supplied through the pipe 46?

A. The effect of the pressure in the pipe 46 would be to increase the friction between the stopcock body and its containing case, the friction increasing as the pressure increases. By "friction" I refer to the friction which would resist or retard the turning of the valve to increase or decrease the opening of the valve.

Q. 589. And assuming still that such plug-cock were connected up with a governor likewise attempting to govern the water wheel, supplied with water through the pipe 46, and varying the amount of water supplied to such wheel, what would be the effect upon the sensitiveness or responsiveness of action of such governor, due to the pressure of such water upon this plug-cock valve?

A. The effect of the pressure on the stop-cock valve would be to retard the governing, or it would be necessary for the mechanism which responds, through any appliance, to a change of speed, to first overcome the friction before the valves were put in motion, and as this friction is increased, the delay in the movement of the valve would be increased, thereby diminishing very materially the sensitiveness of the governing mechanism.

Q. 590. If the co-efficient of this friction existing between such stop-cock valve and its case in such train of mechanism, including a governor, were so high as to produce a retarding action greater than the impelling force applied to the governor itself, what would be the effect upon the operation of the governor?

A. The governor would not act at all, because the valve would not be moved, on account of the excessive friction.

Q. 591. In your previous testimony you have discussed a water-wheel governor known as the Lombard governor, and exemplified in Complainant's Exhibit X, Lombard Governor Company illustrative Folder of Lombard Governor Device. Now, assuming that in a given hydroelectric installation, such a Lombard governor were installed for governing the wheel, and there were connected up with it a by-pass having therein a stop-cock valve similar to that you have discussed in connection with this blueprint still before us, what would be the effect upon the operation of such Lombard governor of the friction engendered between the stop-cock and its case, in an attempt to turn the stop-cock, assuming that such stop-cock were of a size proportionate to the dimensions and the general capacities of the governor and other features of the plant?

A. The effect would be, if such a governor as the socalled Lombard governor, which governor actuates as a result of a change of speed, that, on account of the excessive friction of the stop-cock type of valve in the by-pass, the speed would change very materially before the governor would cause any change in the position of the

by-pass valve, and if the friction were sufficiently excessive, it is very probable that some part of the governing mechanism might be insufficiently strong to change the position of the by-pass valve of the stop-cock type. At any rate the friction would cause a decided change in speed before the valve would be moved to correct for this change of speed; causing what is always termed a governor that works sluggishly, or is not properly sensitive to small changes of speed.

Q. 592. And what would be the effect on the governing or regulation of the water wheel included in such system?

A. The governing or regulation would be quite unsatisfactory.

Q. 593. And what would be the effect upon the maintaining of the water wheel at a proper normal speed to prevent fluctuation in the circuit supplied by the generator included in such system?

A. The effect would be that it would be impossible to maintain a uniform speed of the water-wheel under such conditions.

Q. 594. And would that, or would that not be considered a satisfactory, or in any sense suitable governing, in the present state of the art of hydroelectric practice?

A. It would not only be unsatisfactory, but under present operating conditions it would be intolerable and absolutely out of the question.

Q. 595. Assuming the plug-cock valve in this Berry Blueprine No. 1 before us to be of dimensions in proportion to the other dimensions indicated in the blue-

print, such as the dimensions of the water wheel and penstock, and that there were approximately 600 feet head of water supplying such penstock 46, can you state approximately what the frictional factor would be as existing between the stopcock and its case in an attempt to turn the stopcock?

A. In my opinion the friction would be so great that no possible governing mechanism would move the valve under such conditions, at all.

Q. 596. Now, referring further to Complainant's Exhibit A, being copy of the Lyndon patent in suit, what type of valve do you find as disclosed in this patent as installed in the by-pass 47?

A. The type of valve is what is commonly known as a butterfly valve; this being definitely indicated by the sentence on page 2 of the patent, beginning with line 73, and reading as follows: "A valve 48 in this by-pass is operated by ropes 51, 52, attached to opposite end of a lever 50 on the stem 49 of said valve, these ropes passing over idlers 53 and around pulley 54, being secured at the ends to said pulley."

Q. 597. What is the distinguishing characteristics of such a butterfly valve?

A. The distinguishing characteristics of such a butterfly valve is that it is what is commonly called a balanced valve, and no matter what is the difference in pressure between the two sides of the valve, there is no change in the amount of turning effort required to change its position; nor is there in such a by-pass valve any friction whatsoever in its action between the outside casing and the valve itself.

Q. 598. And as a by-pass valve to be connected up with any governor, or a governor such as the Lombard governor we have just referred to, for the purpose of governing a water-wheel, what have you to say in comparing the performance of such a butterfly valve with the performance of a stop-cock valve such as that you have discussed in connection with Berry Blueprint No. 1, still before us?

A. The operation of the butterfly valve, being free from friction under any conditions of operation, will be much more easy; will at all times be in a balanced condition, whether entirely opened, or entirely closed, or at any intermediate point; and in changing the position of the balanced valve there will be no friction whatsoever to overcome; while in the stop-cock type of valve it is impossible to eliminate the friction, particularly at such time as the valve is set in one position; with the general result that the operation of such a butterfly valve in a by-pass, in connection with the operation of a governor, will give a very much more satisfactory result in connection with the maintaining of a constant and unvaried speed of rotation.

Q. 599. And in the use of such butterfly valve in a by-pass, will there or will there not be any tendency of the valve to stick and oppose the commencement of its movement, responsive to the governor?

A. There will be no tendency to stick as the result of friction.

Q. 600. And how with respect to the use of the stop-cock valve in a by-pass?

A. The stop-cock valve would be, as the result of

friction, held in a given position until sufficient thrust should come from the governing mechanism to start it in motion, after which this thrust would be more than necessary to move it, and would therefore result in the valve being opened farther than necessary.

Q. 601. Will you please now compare the action of the stop-cock valve of Berry Blueprint No. 1 and the case with which it frictionally engages with the action of a band brake and the service to which the band brake is applied?

A. Well, the comparison would be as follows: The rotating cylindrical body of the stop-cock type of valve would correspond with the pulley; the outer surface of the cylindrical body of the valve corresponding with the pulley face. The valve casing would correspond to the brake or brake shoe that is pressed against the cylindrical stop-cock body, and the friction is therefore the same between the rotating cylindrical stop-cock body and the casing of the valve, as is the case with a rotating pulley or wheel, when pressure or friction results between the face of the pulley and the brake itself.

Q. 602. What, in this braking action of the stop-cock in its case, corresponds to the pressure applied to the brake shoe to bring it against its co-engaging part?

A. The pressure of the water in the pipe 46 corresponds to the pressure which would be exerted upon the brake shoe.

Q. 603. What would be the result upon the proper ~~action~~ of a water wheel governor if such a brake were included in the train of parts connected up with the governor and intended to be moved thereby?

A. It would delay, or, if the braking effect were sufficient, prevent the movement of the valve and make the governing entirely unsatisfactory.

Q. 604. Would it be possible for any smooth uninterrupted governing movement to take place with such a retarding brake?

A. In my opinion it would be impossible.

Q. 605. Did you ever know or hear of a successfully operating water wheel governor, to the train of moving parts of which such a brake device was applied?

A. No, sir, not when continuously applied; the difficulty being that the friction will vary with conditions that are absolutely beyond control, due to foreign matter or grit, or sand in the water, or change of temperature, or wearing of the surfaces which are always rubbing together, namely, the surface of the cylindrical body of the stock-cock valve, and the containing case.

Q. 606. And irrespective of what the fit between the stop-cock and its case may be, assuming such a stop-cock and case were provided in connection with such a governing apparatus, would or would not such co-efficient of friction exist between the case and the stop-cock?

A. The friction would exist quite independent of any possible construction of adjustment, or condition of operation.

Q. 607. And would or would not the pressure of the water always hold the stop-cock against its case?

A. Yes, sir.

Q. 608. Have you ever heard of any such governing mechanism, in the train of moving parts of which a retarding brake was included, so that its action would

occur during the movement of the governor part in the governing of the wheel?

A. No, sir, I never have.

Q. 609. In your previous testimony you have referred to a number of complainant's exhibits disclosing the alleged infringing structures of the Division Creek plant and the Cottonwood plant in Inyo County, California on the line of the Los Angeles aqueduct, among such exhibits being Complainant's Exhibit KKK. Referring to this Complainant's Exhibit KKK, what type of water wheel gate valve and by-pass valve is disclosed therein?

A. The so-called needle type of valve for both the water gate valve and the by-pass valve.

Q. 610. How does that needle type of valve compare with the butterfly type of valve disclosed in complainant's exhibit A (copy of the Lyndon patent in suit), in the particulars which you have discussed to-day?

A. The needle type of valve, and the butterfly type of valve have, in common, the elimination of friction of the moving part of the valve on its seat or casing, as a result of the pressure of the water. Both the butterfly type of valve and the needle type of valve have, in common, the characteristic that the degree of opening of the valve may be at any time changed, whether from the position of being entirely closed to the position of being entirely opened, without necessitating the overcoming of any friction between the moving part of the valves and the surrounding case.

Q. 611. Is there, or is there not any essential difference between the needle type of valve and the butter-

fly type of valve, as far as the responsiveness of the same to governing action is concerned?

A. There is no essential difference, no, sir.

Q. 612. I now call your attention to "Complainant's Exhibits Wilson sketches A, B, C, D, and E", and will ask you if you understand what is portrayed therein?

A. I believe that I am familiar with what is indicated in the drawings and lettering of the five exhibits mentioned, A to E, inclusive.

Q. 613. Do you find shown therein any friction types of valves?

A. Yes.

Q. 614. Do you find disclosed therein any frictionless types of valve?

A. Yes.

Q. 615. Please state where, in these sketches, you find these samples of valves?

A. In "Exhibit A" there is shown the frictionless valves, both for the water gate and the by-pass, these valves being of the needle type. In Exhibit B there is shown a by-pass valve of the butterfly type, which is frictionless; and also water gate valves that are frictionless. In Exhibit C there is shown a by-pass valve of the stop-cock type, in which it is impossible to eliminate the friction resulting from the water pressure; and there are also shown water gates of the frictionless type. In Exhibit D there is shown a by-pass nozzle and also a water-wheel nozzle, the opening or closing of both of these nozzles being accomplished by a valve plate; the friction between this valve plate and the valve seat being dependent almost directly upon the water pressure,

itself, and is of a particularly striking type of valve as regards excessive friction resulting from the water pressure. In Exhibit E there is shown a water gate valve, and also a by-pass valve, the opening and closing of both of these valves being accomplished by plates, there being a separate plate for the water gate valve from the plate of the by-pass valve. In these type of valves there is inevitably excessive friction as a result of the water pressure.

Q. 616. I now call your attention further to Berry Blueprint No. 1 still before us, and Defendant's Exhibits MZ, ZZ and XX, and ask you if you understand generally what is disclosed in these exhibits, referring particularly to figure 1 of Berry Blueprint No. 1, taken in connection with the other three exhibits.

A. I have examined them, and I believe I do understand how the mechanism is constructed, and how it is operated, and the method of its use.

Q. 617. By what shaft do you understand the fly-wheel M of Exhibit MZ, and the fly-wheel B of Exhibit ZZ, is carried?

A. The fly-wheel M is carried by the shaft A in Exhibit MZ. The fly-wheel B is carried presumably by the shaft which is marked H. In figure 2 of the Berry Blueprint No. 1, the fly-wheel 1 is carried by the shaft 11.

Q. 618. Which is the shaft of which apparatus, the water wheel, or the generator?

A. It is the shaft of the generator.

Q. 619. Do you take it that these several exhibits are intended to agree with respect to the mounting of this fly-wheel?

A. I do, yes.

Q. 620. Then assuming the fly-wheel to be carried by the generator shaft, and the part B in Exhibit MZ to be carried by the water-wheel shaft, how is the rotation of the water wheel shaft transmitted to the generator shaft?

A. The power is transmitted from the water wheel shaft to the generator shaft (referring to figure 1 of Berry Blueprint No. 1) through the links 6, 6, connected to the lever arms 2, 2, which are pivoted respectively, at the points 4, 4, containing weights respectively 3, 3.

Q. 621. And the lever arms are pivoted at 4, 4, to what?

A. Pivoted at 4, 4, to the spokes of the fly-wheel 1.

Q. 622. What determines the positions of those lever arms?

A. The position of the lever arms, 2, 2, is determined by the balancing of two forces—one, the force resulting from the speed of the rotation of the fly-wheel 1 tending to throw out the weights, 3, 3, the restraining force to this throwing out as a result of the speed, being accomplished by the tension of the springs, 5, 5, with the result that when the fly-wheel is at rest the lever arms 2, 2 will be held down and in contact with the lugs, not numbered, on the interior of the fly-wheel, but as a result of the tension of the springs, 5, 5. But, as the speed of rotation increases, the lever arms 2, 2, will be thrown out on account of the rotation acting on the weights 3, 3.

Q. 623. Now, let us assume that the generator is being driven by the water-wheel at normal speed at normal load; what will be the position of the lever arms 2,

2, with respect to the position shown in figure 1 of Berry Blueprint No. 1?

A. The lever arms 2, 2, will be thrown out from contact with the lugs at the ends of the lever arms 2, 2, and restrained from being thrown entirely against the rim of the fly-wheel by the tension of the springs 5, 5.

Q. 624. Now, let it be assumed that the lever arms 2, 2 are connected up with the water wheel gates to move the same in closing and opening directions and in governing action, and the load upon the generator is reduced; what will be the direction of movement of the lever arms 2, 2?

A. If the load upon the generator is reduced, and all other conditions remain the same, particularly the water pressure, the tendency will be for the lever arms 2, 2, to be thrown out, as a result of the increased speed.

Q. 625. Now, let us assume that the load on the generator remains constant, and the levers 2, 2 are in their normal position, and the speed of the water wheel is increased; what will be the effect produced upon the lever arms 2, 2?

A. If the speed of the water wheel is increased?

Q. 626. Yes.

A. And if all other conditions remain the same?

Q. 627. Yes.

A. Then the lever arms 2, 2 will be thrown out towards the rim of the fly-wheel.

Q. 628. Then, am I to understand that the same direction of movement of the lever arms takes place, either upon decrease of load upon the generator, or increase of speed of the water wheel?

A. Yes, sir.

Q. 629. Now, under both of these conditions is it or is it not true that the rotation of the water wheel shaft is still imparted to the generator through these pivoted lever arms 2, 2?

A. Yes, sir.

Q. 630. And if, as supposed, the lever arms are connected with governing mechanism for controlling the positions of the water wheel gates, does it or does it not follow that the movements of these lever arms, upon change in load, or change in speed, is affected by the transmission of rotation from water wheel to generator through these arms?

A. Yes; the fact being that the device as set forth in Exhibits MZ and ZZ, and in figure 1 of the Berry Blueprint No. 1, is in reality not the governor at all; it is essentially and fundamentally what is commonly known as a transmission dynamometer, or a device to measure the amount of power transmitted between two shafts that are not otherwise connected together except by the device, the transmission dynamometer itself. Independent of the speed, within reasonable limits, and of the load, so-called, within reasonable limits, the position of the lever arms 2, 2 will depend only upon the amount of power that is transmitted, which amount of power transmitted is made up of the product of the speed of rotation and the amount of effort necessary to turn the driven shaft.

Q. 631. Is it or is it not proper to say, in consideration of this device shown in the exhibits now before us, that the transmission of power from the water-wheel

shaft to the generator takes place through the element which in turn actuates the governor?

MR. WESTALL. That question is objected to as leading.

A. Yes.

Q. 632. (BY MR. BLAKESLEE:) What have you to say in this connection as to the accuracy, responsiveness and sensitiveness of governor operation by any such primarily transmission element as you have pointed out this device, including the lever arms 2, 2, to be?

A. I should say that as a governor for constant speed it could not possibly work satisfactorily, because of the fact that it is responsive to a change of load, even if the speed is absolutely constant; and at the same time it is responsive to a change of speed, even if the load is constant. The device would work satisfactorily if this were the desired result, namely, that the amount of power to be transmitted between the water wheel shaft and the generator was to be maintained constant at varying speeds, or, to put it more directly, it is not only responsive to change of speed, other things being equal, but it is responsive to change of load, even if the speed is absolutely constant; and, due to this latter fact, it could not possibly operate satisfactorily to maintain constant speed of the generator with varying loads upon the generator, it being a transmission dynamometer rather than a constant-speed governor.

Q. 633. As far as accurate or satisfactory governing by the use of any such device as we are discussing is concerned, please compare the action of this device as shown in these exhibits, with the lever arms 2, 2 free

to play pivotally, and the action of such device, if such lever arms were fixed or locked against any play whatever, keeping in mind the conflict which you have testified as existing between the attempts of the pivotally mounted lever arms 2, 2 to shift their positions upon change of speed or load, and the power applied through them from the water wheel shaft to the generator?

A. If the arms 2, 2 were not restrained by the tension of the springs 5, 5, at a very small speed of rotation they would be thrown out so that the ends would strike against the interior of the fly-wheel rim.

Q. 634. Possibly my question was somewhat involved, and I will restate it this way; inasmuch as you have testified that a conflict exists between the attempts of the pivotally mounted lever arms 2, 2 to change their positions, responsive to change in load or change in speed, and the force of the drive through these lever arms from the water wheel to the generator, what have you to say in comparison of the pivotal mounting of these arms with the fixed mountings of these arms, as far as obtaining any satisfactory governing action is concerned?

A. I don't know that I can answer that question except in a general way, to say that the governing would be practically as good if the arms 2, 2 were rigid, and not free to rotate as if they are affected by the weights 3, 3.

Q. 635. Referring again now to the Lombard Governor, to which you have testified, as portrayed in Complainant's Exhibit X, Lombard Governor Illustrative Folder of Lombard Governor Device, can you conceive of any possibility of transmitting the rotation of a water wheel shaft through the speed-sensitive parts connected

with the fly-balls 30, so as to operate the generator, and at the same time permit the governor to operate and produce any satisfactory governing result?

A. A satisfactory governing result would be absolutely impossible under such circumstances.

Q. 636. And is or is not that true, regardless of the size or dimensions of such speed-sensitive parts?

A. Absolutely independent of the size, dimensions, material or construction or anything else, of the parts themselves.

Q. 637. Do you find in Berry Blueprint No. 1, taken with "Defendant's Exhibits MZ, ZZ and XX", any governor device which corresponds in construction, function or performance, with, or is in any sense equivalent to the governor mechanism of Complainant's Exhibit A?

A. No, sir, I do not, for the reason that in the Lyndon disclosure the governing mechanism is entirely dependent upon speed, absolutely irrespective of load, a change in the speed of rotation causing the governing mechanism to act; while in the Berry Blueprint No. 1, and in Exhibits MZ, ZZ and XX the operation of the device changing the wheel gate opening, as well as the by-pass opening, is just as effectively brought about by a change of the load, with constant speed, as it is with a constant load and a variable speed. In other words, the two have an entirely different object, and work absolutely to get a different result.

Q. 638. Are we to understand you as testifying that the construction in these exhibits would as a fact produce any movement of the water-wheel gate, or of the by-pass device, or both, as a certainty?

A. Referring to the Berry Blueprint?

Q. 639. Yes, referring to the Berry Blueprint No. 1 and associated exhibits?

A. No, there is no certainty that a change of speed would cause any movement whatsoever of either the water gates, or the by-pass valve.

Q. 640. How about change of load?

A. Change of load might come about without in any manner causing any change in the position of the water gates, or the by-pass valve.

Q. 641. In the action of the governor mechanism of Complainant's Exhibit A, does it or does it not make any difference whether the head or volume of the water supplied to the wheel varies, or any other condition varies, namely, any condition affecting the water wheel, as far as responsiveness of the governing mechanism is concerned?

A. No, the water pressure might vary within very wide limits, and every other condition might vary within the widest possible limits, but the only condition which would affect the governing mechanism would be a variation in the speed of rotation of the wheel itself. In other words, it is a speed-regulating device, or governing mechanism definitely and specifically, independent of all other variable factors.

Q. 642. Now, is or is not that also true with respect to the action of the Lombard governing mechanism, as you have found it to exist in the defendant's alleged infringing structures, as portrayed, for instance, in Complainant's Exhibit KKK?

A. Yes, the same is true as regards Complainant's Exhibit KKK, setting forth in detail the operation of

the Lombard governor to maintain constant speed, irrespective of variation in head upon the water wheel, load upon the generator, or any other condition of operation.

Q. 643. And is the same also true with respect to defendant's alleged infringing structure portrayed in Complainant's Exhibit LL?

A. Yes, the same is true of Complainant's Exhibit LL, which is an exhibit showing a governor for the purpose of maintaining constant speed of the generator irrespective of variation in load upon the generator, water pressure in the pipe line, or any other conditions.

Q. 644. Referring to the disclosures of Defendant's Exhibit Berry Blueprint No. 1, and Defendant's Exhibits ZZ, MZ and XX, what, if any provision is there made for taking care of or governing, in view of changes in volume or head of water supplied to the wheel?

A. There is no provision whatsoever made in the devices as set forth in Berry blueprint No. 1, and Defendants' Exhibits XX, MZ and ZZ.

Q. 645. Do you consider the disclosures of these four exhibits last named to comprise, either theoretically or practically, operative, satisfactory or successfully working design and construction?

A. Fundamentally, both theoretically and practically unsatisfactory in design and conception for the purpose of maintaining constant speed with variation of load, variation of head, and other variable conditions inseparably connected with the practical operation of electrical generators driven by water wheels.

Q. 646. Do you find the whole of, or any essential

part of the invention disclosed in Complainant's Exhibit A embodied in the disclosures of these four other exhibits still before you?

A. The only thing in common between Defendant's Exhibit Lyndon patent, and the disclosure of Berry Blueprint No. 1, Defendant's Exhibits XX, MZ and ZZ, that I can find, is that in both a by-pass valve is mentioned; the matter of fact being that the type of by-pass valve mentioned in the Lyndon patent is entirely operative, while the by-pass valve in the Berry Blueprint No. 1, and the other exhibits mentioned would be inoperative, as a result of friction, even if it were controlled by a satisfactory governor for constant speed. That is the only thing in common in the two disclosures when contrasted.

Q. 647. Do you find ⁱⁿ the Berry Blueprint No. 1 and the three associated exhibits still before you, any showing or suggestion of any means whatsoever for returning the purported by-pass valve to a usual or pre-determined position after it has moved in conjunction with the water-wheel gates?

A. No, sir, I do not.

Q. 648. Referring further to Complainant's Exhibit A, will you please state from the teachings of this patent, what positions you would elect to station the by-pass valve in as its usual position under varying conditions of service, as, for instance, when you desired to save water; when the saving of water was not material, when the pipe line or penstock was long; when the pipe-line or penstock was short, and when the inclination of the pipe-line or penstock was great or small, or any

other conditions which might make the selection of such position a matter of preference, or the consideration of same wise?

A. The disclosures in the Lyndon patent set forth very clearly that the normal position of the by-pass valve may be anything which is desired by the operator to conform with the particular conditions existing; if, for instance, the saving of water is of prime importance, and there are only slight variations in the load, which will cause a variation of speed, the by-pass valve may be maintained in its normal position, practically, closed or nearly so; on the other hand, in the case of very long pipe line, or in a case of a load which is subject to very large fluctuations, these fluctuations coming very suddenly, my experience in such plants would indicate the desirability of operating the plant with the by-pass valve somewhere around half open. The adaptability of the Lyndon device to all conditions of operation, and yet maintain constant speed, is particularly important, inasmuch as what might be called the normal position of the by-pass valve can be made to suit the particular conditions existing in any given case.

Q. 649. I now call your attention to Defendant's Exhibit Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart, and call your attention to the matter on page 19, which sets forth an efficiency of 81 2-10ths per cent at full load, with 703.1 horsepower, and ask you if you consider that to be a good efficiency under those conditions; assuming this report to refer to the operation of a hydro-electric generating plant?

A. I would assume that an efficiency of 81.2 per cent

of the water wheels at full load, corresponding to 703.1 horsepower, would be reasonably satisfactory.

Q. 650. Would that be so considered in the present state of the art?

A. For that type of wheel, yes.

Q. 651. How with respect to the types of wheels as portrayed in the various exhibits showing the defendant's alleged infringing structures, such as Complainant's Exhibits KKK, or any of the exhibits which you have reviewed in any of your testimony in this case, showing the construction of the defendant's alleged infringing structure?

A. I should think that that efficiency of 81.2 per cent at full load would be a reasonably satisfactory efficiency.

Q. 652. Strictly from the standpoint of such efficiency, would such efficiency warrant the rejection of any hydro-electric installation?

A. In my opinion it would not.

Q. 653. Would your observations likewise apply to such hydro-electric plant, the water wheels of which had a maximum capacity of 750 horsepower, instead of 703.1 horsepower; the test producing 81.2 per cent efficiency being made at 703.1 horsepower?

A. No, sir, I would not consider that, based on the efficiency only, there would be justification for rejecting a wheel of a normal rating of 750 horsepower, if at 703.1 horsepower the efficiency was 81.2 per cent.

Q. 654. I now refer you to page 17 of this exhibit, to the part entitled Table 5, and ask you whether or not you have prepared any tabulation or chart showing, which corresponds to the conditions and propositions

stated in this Table 5; and if so, please produce same.

A. Yes.

(The witness produces a chart in red and black lines, on white paper.)

Q. 655. Will you now please state what this chart signifies, pointing out the various features and details thereof?

A. This chart signifies a graphical representation of the fluctuation or changes in speed, following definite changes in load, which have been plotted from the so-called Cobb Efficiency Report, as set forth on Table 5, page 17, being the exhibit I have before me, wherein the normal desired speed is 257 revolutions per minute, and where the load was suddenly increased from 5-16ths of full load to 7-16ths of full load, the speed fluctuated between a maximum of 260 r.p.m., and a minimum of 250 r.p.m. Further, when the load was increased from 7-16ths of full load to one-half of full load, the speed fluctuated between a maximum of 260 r.p.m., and a minimum of 248 r.p.m. Again, when the load was still further increased from one-half full load to three-fourths full load the speed fluctuated from a maximum of 262 r.p.m. to a minimum of 245 r.p.m. Further, when the load was suddenly dropped or decreased from three-fourths of full load down to one-half of full load, the speed fluctuated from a maximum of 270 r.p.m., to a minimum of 247 r.p.m. Then when the load was again increased from one-half full load to three-fourths full load, the speed decreased to a minimum of 245 r.p.m., and fluctuated to a maximum of 262 r.p.m. And then when the load was reduced from three-fourths full load

to three-eighths full load, the speed fluctuated between the still wider limit of a maximum of 272 r.p.m., to a minimum of 245 r.p.m.

Q. 656. What do such fluctuations in speed signify with respect to any attempted governing action in this installation?

A. It signifies absolutely unsatisfactory governing action, because what should occur, and actually does occur in the properly governing devices, if the load, for instance, is increased the speed may drop ~~to~~^{two} or three revolutions, but does not ever exceed normal speed. In other words, to use the common engineering expression, the speed does not fluctuate above a normal and then below normal, and then above normal, and finally return to normal speed.

Q. 657. And that back and forth fluctuation occurs in accordance with the chart readings you have just recited, and a "hunting" action of the governor take place?

A. Yes, sir, it did, as set forth in Table 5, page 17, of the Cobb Efficiency Report.

Q. 658. And what was the effect upon the electrical energy consumers supplied by the circuit energized by this plant upon which this report was prepared?

A. A very wide fluctuation, not only of the electric pressure or voltage, but what is perhaps of even more serious consequence, with electric motors, a fluctuation of the frequency of the alternating current supplied from such generator, which frequently is directly proportional to the speed in revolutions per minute.

Q. 659. And would such energy consumers be serviceably so supplied with energy in the industries today?

A. Such service would not be at all possible with electrical consumers at the present time, where the fluctuation of frequency is many times limited by contact, not to exceed as a maximum one per cent either above or below normal.

Q. 660. What is indicated on this chart in the central portion of it?

A. In the central portion is indicated the normal speed with a good speed governor, wherein is shown the reduction in speed from the normal operating speed of 257 r.p.m., to about 255 r.p.m., when the load is increased from 5-16ths of full load to 7-16ths of full load. Again, a reduction from the normal speed of 257 r.p.m. to a little less than 256 r.p.m., the load was still further increased from 7-16ths of full load to one-half of full load; and a reduction from the normal speed of 257 r.p.m., to approximately 253 r.p.m., the load was still further increased from one-half of full load to three-fourths of full load; and then when the load was decreased or reduced from three-fourths of full load to one-half of full load the normal speed of 257 r.p.m. was increased thereby to 261 r.p.m.; and then, when the load was again raised from one-half of full load to three-fourths of full load, the normal speed of 257 r.p.m. was reduced again to 253 r.p.m.; and then again, when the load was reduced or decreased from three-fourths of full load to three-eighths of full load, the normal speed of 257 r.p.m. was thereby increased to 263 r.p.m. In no case, however, in this proper speed governing, after the speed is reduced as a result of increasing the load, is the speed allowed by the governor to increase above normal

by the so-called "hunting" action; nor, on the other hand, when the speed has been increased as a result of the reduction in load, will the speed fluctuate below normal, because the proper action of the governor provides this wide fluctuation or so-called "hunting."

Q. 661. And the fluctuations indicated in the upper tier of this chart, compared with the fluctuations indicated in the central tier of this chart, show, do they, the differences between the fluctuations indicated in this Cobb Efficiency Report and the fluctuations which should occur in a well-governed hydro-electric plant under similar conditions?

A. Yes, sir.

MR. BLAKESLEE: Upon preparation of a photographic copy of this chart we will offer the same in evidence as Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart.

Q. 662. I now call your attention to that matter on page 18 of this "Defendant's Exhibit Cobb Efficiency Report" as follows:

"The by-pass valves are not reliable and have so far given a great amount of trouble, and should be replaced by a construction that will render it possible to operate them with certainty by the hydraulic cylinder provided in part for that purpose".

Does this observation in the report coincide with your engineering opinion and belief as to the theoretical and structural objections pertaining, and the disclosure of Berry Blueprint No. 1, or a device built in accordance therewith, and in line with your testimony of this afternoon?

Q. 663. And in connection with this same observation, if you were to replace the by-pass valve or valves by another construction that would render it possible to operate them with certainty, what type of by-pass valve would you substitute?

A. I would substitute some type of practically frictionless by-pass valve, such as a butterfly valve, or a needle valve.

July 9th, 1915. A. M.

Q. 664. I will call your attention again, Mr. Cory, to Complainant's Exhibit A (copy of Lyndon patent in suit), and will ask you whether, in accordance with any interpretation of the disclosures of that patent, it would be possible to transmit the rotation of the water wheel to the generator through the agency of the speed-sensitive dynamo device 8 disclosed in that patent?

A. Yes, sir, it would be possible.

Q. 665. If that were done would or would not such speed-sensitive element be permitted to perform its proper function as a member of the governor organization?

A. Yes, sir, it would perform the same function.

Q. 666. How would it be possible so to connect up the water wheel and generator through this dynamo 8?

A. It would be possible in a number of different ways. Perhaps the most apparent one would be to mount the speed sensitive device 8 on the same shaft as the main shaft of the water wheel which drives the generator; in which case the speed-sensitive device and the water-wheel shaft and the generator shaft would all be practically operated on the same shaft and therefore at

the same speed; which would be practically the equivalent of the disclosure as set forth in the Lyndon patent.

Q. 667. In that case would the joint operation of the water-wheel and generator and the dynamo 8 coupled up with them, in any way change the performance of the speed sensitive dynamo 8?

A. No, there would be no change whatever in the operation of the entire equipment, including the speed-sensitive device or dynamo 8.

Q. 668. And if the wheel, generator and dynamo 8 of the Lyndon patent disclosure were so connected together, would or would not the speed-sensitive field of the dynamo 8, which changes the pull upon the solenoid 33, be affected?

A. It would not be affected at all.

Q. 669. What I was aiming at in a previous question was to determine whether the wheel of the Lyndon patent and a generator operated thereby could be connected up through the agency of the speed-sensitive part of the dynamo 8 so that the generator could be operated by water wheel through such speed-sensitive part, and such speed-sensitive part still retain its speed-sensitive function for governing purposes?

A. Yes, sir, it could so be done and get exactly the same result as regards the operation of the speed-sensitive dynamo 8.

Q. 670. I am now assuming that the speed sensitive dynamo 8 is operated from the wheel shaft, and further assuming that the generator is to be further operated through the energy generated by the dynamo 8, and a further motor to operate the generator; calling your at-

tention to the fact that the specification of the Lyndon patent, in the last paragraph on page 2—that the dynamo 8 is compound wound in a manner to give constant potential at the terminals with constant speed, independent of the variation of current; and also to the matter in lines 39 to 46 on page 3, which set forth that a slight increase in speed of the armature will give an increase in voltage, due first directly to the increase in speed, and second, to the increase in magnetic density which later increases because of a greater current flowing through the shunt windings, caused by the slight increase of voltage. Would it be practicable or possible to so cause the final drive of the generator supplied by the wheel and at the same time obtain sensitive governing action?

A. I presume by the word “generator” you refer to the main electrical machine driven by the water wheel from which electric power is taken.

Q. 671. Yes, I have distinguished by calling number 8 a dynamo, and the generator I refer to is the generator driven by the water wheel for supplying the service from the station.

A. No, it would make no difference whatsoever in the operation of the speed-sensitive device or dynamo 8 if the current from this dynamo 8 in part were used to excite the field of the main generator, using the alternating current, in addition to there being supplied also from the small dynamo 8—the speed-sensitive device—current for the operation of the solenoid 33; in which case dynamo 8 would be used for two purposes; first, the speed-sensitive device in connection with the operation of the governor, and, second, as a direct-cur-

rent machine, ordinarily known as an exciter, to furnish direct current to the fields of the main alternating current generator driven by the water-wheel.

Q. 672. But, my question involved, not the excitation of the field of the main generator, but rather, the energization of a motor to rotate the field or armature of such main generator. Under those circumstances would practicable governing be possible?

A. I doubt it very much, because in that case the dynamo 8 would be as large a machine as the main generator, and it would also supply energy for the motor, which would, in turn, drive the main generator, and sudden fluctuations of load upon the main generator would interfere somewhat with the uniformity of the current that would also be delivered from the small dynamo 8, which would now be a large direct current dynamo supplying to the coil 33. Still, it might be possible to get satisfactory governing, although it would add an additional burden to the speed-sensitive device—the small dynamo 8—to operate in this manner.

Q.; 673. If you operated in such manner, would or would not fluctuations in the circuit supplied by the service generator affect the potential of the dynamo 8 in such manner as to impair its function as primarily a speed-sensitive governor controlling element?

A. In my opinion it would in practical operation seriously impair its effectiveness as a speed-sensitive device.

Q. 674. And would not, of necessity, the dynamo 8, so utilized in such dual capacity, be larger, in terms of capacity, than the generator driven through it?

A. Yes, sir.

Q. 675. What have you to say as to any loss of energy in such combination of features, incident to conversion and a reconversion of energy by the use of two generators and interposed motor?

A. There would be considerable excess and unnecessary loss between the mechanical power delivered from the water-wheel and the electrical energy ultimately delivered from the main generator.

Q. 676. Therefore, in these connections, is there or is there not any analogy between the impracticability of so driving the service generator of the plant through the speed-sensitive dynamo 8 of the Lyndon patent disclosure, and the impracticability you have pointed out of driving the service generator through the speed-sensitive element, including the fly-balls marked C, of Complainant's Exhibit KKK, as exemplifying the defendant's alleged infringing structures?

A. Yes, sir, there is an analogy.

Q. 677. In the construction disclosed in Defendant's Exhibit Berry Blueprint No. 1, please again state whether or not the drive of the service generator takes place from the water wheel through the intended speed-sensitive part of the dynamometer shown particularly in figure 1, such part including the weighted lever arms, 2, 2?

A. The service generator, as shown in the Berry Bluperint No. 1, is driven by the water-wheel through the power transmission dynamometer as shown in figure 1; and therefore, not only interferes, but absolutely prevents the power transmission dynamometer figure 1,

from being a speed-sensitive device solely; since all the power required by the main generator must be transmitted through the device as a power transmission dynamometer.

Q. 678. And is it or is it not so transmitted through the movable pivoted lever arm, 2, 2 of this device?

A. Yes, sir, all of the power is transmitted through the lever arm 2, 2, the links, 6, 6, and the crank shaft, 7.

Q. 679. Do you find any suggestion in the disclosure of Complainant's Exhibit A, of any intention or design to drive the service generator through energy developed by the speed-sensitive dynamometer 8?

A. No, sir.

Q. 680. If the lever arm 2, 2 of Berry Blueprint No. 1, and particularly as shown in figure 1 thereof, were locked or stopped against pivotal movement or swing, what would be the result, nature and function of such dynamometer interposed between the water wheel and the service generator?

A. The dynamometer, which I have called a power transmission dynamometer, would then become in effect merely a solid rigid coupling between the water-wheel shaft and the generator shaft.

Q. 681. I call your attention now again to Defendant's Exhibit Lamb patent, and ask you if you find therein disclosed any means for producing a positive inverse movement as between the two valves 9 in any possible governing action of this device?

A. No, sir; there is no positive inverse motion possible as regards the two different valves; the

reasons for this being that the governor is presumed to exert a pull upon the rod 25, which is connected to the center of the bar 24, and the valves themselves are operated respectively by the two lever arms 20, and all of the motion caused by the governor in acting upon the rod 25 will be directly transmitted to either the one valve or the other, depending upon which operates with the least friction; there being absolutely no positive, definite inverse action possible between the two valves, since one may move for a considerable distance without the other moving at all, and vice versa.

Q. 682. And as to these valves 9, themselves, within which class, if either, of valves, as previously defined by you—namely, friction valve, or frictionless valve—do said valves 9 fall?

A. The valves 9, as definitely stated on page 2, line 18, are “cylindrical in form, turning in enclosing cases 10 within “the reservoir 4”, and are therefore valves of the friction type, and are not balanced.

Q. 683. What, if any, effect would be produced by this frictional character of these valves 9 upon the action of the lever connection for moving such valves, from the standpoint of the lack of positiveness of inverse synchronous action which you have referred to?

A. The effect of the use of friction valves would be to absolutely prevent the inverse synchronous action of the two valves by the pull or thrust upon the connecting rod 25 from the governor; all of the motion would be transmitted to the valve which had

the least friction—at least, during the first part of the action.

Q. 684. How much of the water admitted to the casing or supplied to this wheel strikes the wheel itself?

A. All of the water strikes the wheel.

Q. 685. I now show you a model device, and will ask you to please compare the same generally with the disclosure of this Lamb patent, and state whether or not it generally conforms to such disclosure with respect to the action of the valves 9 of said patent and the means for operating them in any attempted governing action?

A. The model conforms with the disclosure of the patent, particularly as shown in Figure 4 and the specification describing the operation of the governor rod 25 and the valves.

Q. 686. Will you please state what, if you understand, is the purpose of the frame at the lower part of this model, and the compression springs between the frames and the valves?

A. The two spiral compression springs on the bottom of the model are representative of the water pressure exerted upon the two cylindrical valves 9.

Q. 687. And what is the effect of that water pressure, as to the turning of the valves?

A. The effect of the water pressure is to increase the friction with which the valves operate, particularly the friction which must be overcome upon the initial movement of either valve.

MR. BLAKESLEE: Complainant offers in evi-

dence the model device pertinent to the Lamb disclosure just discussed by the witness, as Complainant's Exhibit Lamb Patent Valve Gear Model," and ask that it be so marked.

MR. WESTALL: Counsel for the defendant objects to the receipt in evidence of the model referred to, as not being shown to be made in accordance with the specifications and drawings of the patent referred to, and as being merely fragmentary.

Q. 688. (By MR. BLAKESLEE:) Does or does not the purported action of the device of this Lamb patent provide for anything further than shutting off a part of the water supplied to the wheel at one nozzle and applying it to the wheel at another nozzle?

A. It does not, the result being that the flow of water through the pipe line is constant at all times, no matter what the load upon the generator may be, so far as doing useful work.

Q. 689. And would the use, or attempted use of any such Lamb device contemplate the taking care of any inertia effect in the pipe line?

A. No, sir; it would not.

Q. 690. As a matter of fact, if the valves of this Lamb patent device did not work simultaneously and inversely, would or would not inertia effects be produced in the pipe line?

A. Yes. The way the disclosure of the patent is indicated to my mind there might be most serious inertia effects in the pipe line, because, as far as the governor rod 25 is concerned, it might stay absolutely still, and yet, due to the fact that there is no in-

verse positive motion whatsoever between the two valves, the entire supply of water might be suddenly cut off, or, if there was a small amount of water flowing in the pipe line, the amount of water might be very suddenly increased, absolutely independent of any control whatsoever by the governor; this being true because of there being no definite, direct and positive relative action between the power-producing valve and the so-called brake-valve. For this reason, in my opinion the entire Lamb device for constant speed control is absolutely inoperative and fundamentally wrong.

Q. 691. Does the same objection lie against the attempted use of any such Lamb device for preventing dangerous inertia effects in the pipe line? .

A. Yes, sir.

Q. 692. Referring now further to the defendant's alleged infringing structures as shown in the several blueprints and other exhibits which you have discussed in your previous testimony, and also referring to Complainant's Exhibit A (copy of Lyndon patent in suit), I wish to ask you a number of questions pertinent to correspondence as between various features of these constructions. I will select Complainant's Exhibit KKK as typical of these defendant structures. In the first place what if any analogy do you find between the fly-ball speed sensitive device, including the fly-balls C of KKK, and the dynamo 8 of the Lyndon patent?

A. The fly-balls C of the speed-sensitive device

KKK correspond to the speed-sensitive device, dynamo 8.

Q. 693. Is there or is there not any difference between the two with respect to the purpose accomplished, the general method of accomplishment, and the general character of means for accomplishing such purpose?

A. No sir.

Q. 694. Now, similarly, what have you to say with respect to the solenoid 33 of the Lyndon patent, and its core 34, and the line-to-line valve B in its casing of KKK?

MR. WESTALL: Counsel for defendant objects to this method of examination as very grossly leading, and it is suggested that the witness should be permitted to pick out the alleged analogous elements.

A. The same applies, and complete and definite testimony in regard to the relative functions of the different parts, as shown in the Lyndon patent, and as designated on blue print KKK, has already been given in great detail in my previous testimony.

Q. 695. (By MR. BLAKESLEE:) Please state whether or not you consider the general disclosure of exhibit KKK and the general disclosure of the Lyndon patent in suit, to represent mechanical equivalents, in as far as the disclosure of Complainant's Exhibit KKK performs the function of inversely moving the water wheel gate or valve and the by-pass gate or valve, returning the by-pass gate or valve to usual position, preventing the overrunning of the

governor and the operation of the governor through a strictly speed-sensitive device?

A. I consider, as set forth completely and in detail in my previous testimony some time ago in this case, that the disclosures of the Lyndon patent are substantially equivalent in every respect to the device set forth on Complainant's Exhibit KKK, and especially as regards the positive inverse action of the water gate and the by-pass valve.

Q. 696. And is there, in your opinion any appreciable difference with respect to the returning off the by-pass valve to its usual position, and also with respect to the prevention of overrunning of the governor?

A. No, sir; there is no difference.

Q. 697. Is there in your mind any want of mechanical equivalents as between the operation of a device or movement of a part through a mechanical train or mechanical group of parts, and the operation of such device or movement of such part through a train or path, either entirely electro-magnetic, or partly electro-magnetic and partly mechanical?

A. No, sir.

Q. 698. Would you consider that a cam and a toggle-joint which both operated to produce substantially the same results in the two machines would be mechanical equivalents?

A. I should say they would be mechanical equivalents as far as the result obtained.

Q. 699. And to your mind would it make any difference as to how the cam and the toggle-joints

were actuated, or how power was applied to them to produce the ultimate movement or effect?

A. No, sir, it would not.

Q. 700. And to your mind is there any advantage with respect to positiveness of transmission of motion as between a purely mechanical train consisting of a number of jointed or connected parts and a train part electro-magnetic?

A. In long-continued practical operation, where forces of considerable magnitude are to be transmitted, I would consider that it would be somewhat of an advantage to use exclusively mechanical parts, although the same definite and positive result could be obtained by a combination of electro-magnetic parts and mechanical parts.

Q. 701. In so far as lost motion is concerned is there any preference as between an electrical path of transmission and a mechanical path of transmission, the latter having parts jointed or connected together?

A. In my opinion there would not necessarily be any preference as regards lost motion, although the lost motion can be reduced to practically nothing with the exclusive use of mechanical parts. This might not be practical under all conditions possible with the combination of electro-magnetic parts.

Q. 702. But, in so far as transmissiion directly through an electrical path is concerned, what have you to say in comparing lost motion in that connection with lost motion through a mechanical train?

A. In a mechanical train I should say there would probably be less lost motion, practically none.

Q. 703. But, I am now assuming that the transmission to a certain point is entirely through an electrical path without any moving mechanical parts or connected mechanical parts; what have you to say in comparison of such path with the mechanical path or connected parts?

A. I would say to that that with the electric transmission exclusively there would be no lost motion, while there would be necessarily a very slight lost motion with a train of mechanical parts.

Q. 704. And in order to produce motion at the end of the electrical path by electro-magnetic means, is it possible to avoid the use of a moving mechanical part or parts?

A. No, sir; there must be some moving mechanical parts of electrical devices.

Q. 705. Therefore, when, in the defendant's alleged infringing structures any action takes place which corresponds to an action taking place in Complainant's Exhibit A (Copy of Lyndon patent in suit) is it or is it not true that such ultimate action is mechanical?

A. It is true that the ultimate action is mechanical.

Q. 706. And with respect to the obtaining of any such ultimate action, is it or is it not material what is the nature of the prime mover at the other end of the train, or what the nature of the train, or what the nature of causation may be?

A. I should say it would be material as to the nature of what the prime mover was, or the causation, yes.

Q. 707. Would be material?

A. Yes, I think it would be material in a broad sense. However, if the causation is definite and the same in each case, it would make practically no difference as to the transmission of that effect, whether it be by electrical means or mechanical means, or a combination of the two.

Q. 708. And in so far as the ultimate object of moving a part is concerend, where the motion is produced through an electro-magnet, is it or is it not material whether the part so moved be directly influenced by the electro-magnet as an armature, or be indirectly moved by the interposition of an armature and connections between the electro-magnet and the ultimately moved part?

A. I should say there would be practically no difference in the two cases which you cite.

Q. 709. I will now ask you to refer again to Complainant's Exhibit A, and also to Complainant's Exhibit KKK as an exemplar of defendant's alleged infringing structures, and to state whether or not you find embodied in such defendant's infringing structures the subjects of claims 3, 4, 6 and 7 of Complainant's Exhibit A?

A. I do so find, yes, sir.

Q. 710. Referring again to defendant's exhibit Berry blueprint No. 1 do you find disclosed therein

anything to prevent the governor from overrunning, within the meaning of Complainant's Exhibit A?

A. No, sir, I do not.

Q. 711. Are you at the present time connected with the faculty of the University of California, as you were when you first testified in this case?

A. Yes, sir.

Q. 712. Please state what chair you occupy in that university, or what the capacity of your membership in that university is?

A. I occupy the position of dean in the college of mechanics, which embraces the instruction in mechanical engineering, electrical engineering, steam engineering and gas engineering and hydraulic machinery, and have direct personal charge of the instruction in electrical engineering as Professor of Electrical Engineering,

MR. BLAKESLEE: We now offer in evidence blueprint of the chart discussed by the present witness yesterday, pertinent to the Cobb Efficiency Report, as Complainant's' Exhibit Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart, and ask that the same be so marked.

Q. 713. Can you think at present of any instance within your experience or observation or knowledge, of a hydroelectric plant in which trouble resulted in the nature of extreme fluctuations in the circuit, and which troubles were eliminated by the installation, with a water-wheel gate or gates and governor, of an inversely operated by-pass valve or valves?

A. Yes, I can think of a number of instances. One I recall is that of a plant of the Truckee River General Electric Company, on the Truckee River below Floriston, California. Another plant is that of the Southern California Edison Company in San Antonio Canyon; and two plants of the Oro Water, Light and Power Company, in Butte County. There are perhaps a number of others that I do not recall just at present.

Q. 714. Do you remember any other instances of this sort in a plant of larger dimensions than those specified?

A. I have in mind the plant of the Washington Water Power Company on the Spokane River, near Spokane, Washington, and also the Crane Valley plant of the San Joaquin Light and Power Company, in Fresno County, I believe.

Q. 715. Do you recollect any such occurrence in any plant of the Great Western Power Company of California?

A. Yes, the plant of the Great Western Power Company at Big Bend, on the Feather River; very unsatisfactory operation as regards constant speed and frequency of the alternating current was corrected by introducing the by-pass valve operated inversely by means of a governor with the main gate valve of a 10,000 kilowatt generator.

Q. 716. Do you remember when this change of installation took place?

A. I don't remember absolutely now what year.

Q. 717. Were such by-pass valves, or were they not of the balanced frictionless type?

A. They were of the balanced frictionless type.

Q. 718. And were they or were they not operated from the governor?

A. They were operated from the governor, yes, sir.

Q. 719. I now show you a blueprint, and ask you if you can state generally what is disclosed therein?

A. This blueprint discloses a diagrammatic, or what might possibly be called a perspective or birdseye view of a portion of the generating and transmission system of the San Joaquin Light and Power Company in the vicinity of Fresno, Bakersfield, etc., wherein are shown three water power plants operating together on the main transmission line. These water power plants being, first, that of the Power Development Company near Bakersfield; second, of the Crane Valley plant of the San Joaquin Light and Power Company and, third, what is known as plant number three of the San Joaquin Light and Power Company. And also upon this same system a steam generating plant in Bakersfield. I am personally familiar with the details of the construction and operation of this plant. The distinguishing feature is that the governing or maintaining of constant speed at all loads is accomplished primarily at one plant, namely, the Crane Valley plant; this hydro-electric plant being equipped with the type of governing device in accordance with the disclosures of the Lyn-

don patent, and essentially as set forth on blueprint KKK, wherein the water gate is operated inversely and simultaneously and positively with the by-pass valve. The plant of the Power Development Company is manually operated, and is not used for governing at all. Under some circumstances the same is true of the steam plant at Bakersfield, although the steam plant is not operated as continuously as the water power plants, it being desirous of saving fuel under those conditions.

Q. 720. What results in the use of this general system with respect to the joining together of the several stations or plants, and the result and control of the same?

A. As in this system of the San Joaquin Light and Power Company, the general practice now is to operate a number of hydro-electric plants, and in some cases steam plants in parallel, as we say, or upon the same general transmission system, it being possible therewith to have all the governing to maintain constant speed with varying load at practically one plant, insuring the use of all the water available at all of the other plants; the advantage, of course, being that if the responsibility for the governing for constant speed at variable load is successfully carried out at one plant, the governing mechanism in one plant serves the purpose of all of the plants, it may be, that are so connected in parallel. This is common practice at the present time, and is very advantageous to the operation of hydro-electric plants and the obtaining of the maximum efficiency from

the water power available, and converting this water power into electrical power.

Q. 721. Is it or is it not, therefore, proper to say that the Power Development Company plant represented in the system as shown by this blueprint is, in effect, or ultimately governed, due to the direct governing which takes place in the Crane Valley plant, and which affects the system including this Power Development Company plant?

A. Yes, sir, all of the governing of the generating plants, including that of the Power Development Company, is accomplished at one plant, namely, the Crane Valley plant.

Q. 722. And that governing is accomplished, is it, or is it not, in accordance with the disclosures and teaching of Complainant's Exhibit A, copy of London patent in suit?

Mr. Westall: The question is objected to as calling for a conclusion of the witness, and not calling for any proper comparison by which the Court can determine whether the conclusion is correct.

A. Yes, sir.

Q. 723. (By MR. BLAKESLEE:) I understand you to say that the general scheme of governing there as to specific details is substantially in accordance with the governing installations of the defendant's alleged infringing structures as exemplified, for instance, in Complainant's Exhibit KKK?

A. Yes, sir.

Mr. Blakeslee: We offer in evidence the blueprint just discussed by the witness, as Complainant's

Exhibit Diagram of System of Control and Circuit, including Power Development Company's present plant.

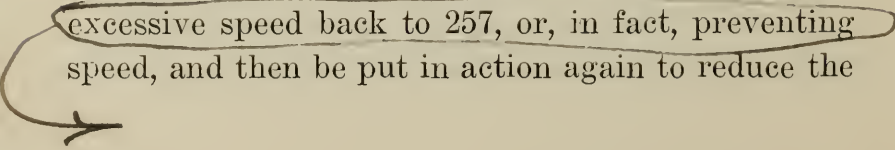
Counsel may now cross-examine the present witness, subject to brief recall for further direct examination.

CROSS-EXAMINATION

Q. 724. (By MR. WESTALL:) Will you please describe as briefly and in as untechnical language as possible what is meant by overrunning, or hunting, when such words are used in describing the operation of a water-wheel governor?

A. When a water wheel is running at what we call normal speed, other things being equal, such as the head of water, if the demand for power from the generator which is being driven by that water wheel is increased, or, as we commonly say, if the load is increased, there will be a tendency instantly, for the speed of rotation of the water wheel to drop. Conversely, if the load is decreased upon the electrical generator, due to the service in electric power which is being rendered from the service connected to the electric generator, there will be instantly a tendency for the speed to rise, as the result of a reduction in the load. Now, it is imperative and absolutely necessary for good electric power service, particularly when alternating current is used—and alternating current is almost exclusively used for large power generating systems—that the speed in revolutions per minute shall remain just as nearly as possible

constant. The function of the water wheel governor, or speed governor, is to hold that speed as nearly as possible constant, no matter what may be the changes in load upon the generator, within very wide limits. Let us consider that the load is suddenly increased on a water-wheel-driven generator: the tendency will be at once for the speed to drop. The governing mechanism has for its object the increasing of the amount of water on the wheel, to bring the speed back to normal; but unless the governor is of the proper modern type, it will allow more water to come on the wheel than is really required by the increased load, with the result that the speed will be increased from below normal to decidedly above normal. Then the governor acts again to reduce the speed, and in so doing it will reduce it down below where it should be. That is called hunting, or fluctuation of speed above and below normal. The modern governor—and the only one that is at all satisfactory at the present time—is one which will bring about the result of bringing the speed back to normal without exceeding the normal, or being less than normal. To use the illustration where the normal speed of a generator is 257 revolutions per minute, if the load is increased upon the generator the speed might drop to 254 revolutions per minute. Now, if a satisfactory governor would gradually, and as soon as possible bring this speed back up to 257 revolutions per minute without at any instant ever exceeding this excessive speed back to 257, or, in fact, preventing speed, and then be put in action again to reduce the



the speed seesawing successively above and below the normal speed, which, in this case, we will assume to be 257 revolutions per minute.

XQ. 725. Might it be said briefly that this seesawing which you have described is what is called governor hunting or overrunning?

A. Yes, sir.

XQ. 726. The word "hunting" seems to be a rather peculiar word to be applied to overrunning, Would you explain why, if at all, you think it correctly describes the action of such governor?

A. The word "hunting" in this connectoin is unquestionably used because of the similarity of the action with the alternating current generator when it is operating as a synchronous motor, that a synchronous motor will tend to what might be called "hunt" its normal speed, and in so doing will run first too fast, and then too slow, an so on, until it finally settles down to what ought to be its normal speed. The word "hunting", I am sure, was introduced in connection with the use of an alternating current generator used as a synchronous motor, and naturall got applied to the same phenomenon in the operation of either water-wheel-driven generators, or steam turbine driven generators, or steam engine driven generators, or gas engine driven generators, or any kind of driving of electric generator.

XQ. 727. The word "seeking" might also be an appropriate term, might it not, in that it conveys the idea of the mechanism endeavoring to adjust itself to a certain set of conditions? Is that correct?

A. I should say seeking the normal speed.

XQ. 728. Do I understand you correctly as having stated upon direct examination, in effect, that a returning device is a mechanical element or combination of elements designed to prevent a governor from overrunning?

MR. BLAKESLEE: The question is objected to as calling for the witness's conclusion, and as being argumentative and attempting a definition in the question, rather than by answer.

A. Yes, sir.

XQ. 729. (By MR. WESTALL:) Would you say that such a returning device was an indispensable part of every governor?

A. I should say absolutely indispensable for every water wheel governor; because, as soon as the governor acts there is a change in the velocity of the water in the pipe line, and the returning device is absolutely necessary to act so as to slowly restore the normal velocity ~~in the pipe line~~ for any given load. A returning device in my experience is absolutely necessary for satisfactory governing, to take care of the inertia of the water in the pipe ine.

XQ. 730. Please describe briefly how a governor not supplied with such a returning device would operate?

MR. BLAKESLEE: Objected to as calling for mere repetition of testimony extensively given, in which the art has been fully exploited with respect to the objectionable features of governing without

the use of such returning device; and not proper cross-examination.

A. A governor not supplied with such returning device would, as the result of the change of speed, due to change of load, or due to change of pressure in the pipe line, increase or decrease the supply of water to the wheel. It would be in my opinion impossible to bring back the speed to normal without such returning device, without overrunning, or causing the seesawing we speak of; because immediately that you increase the opening to the wheel you diminish the pressure at the nozzle, because the column of water cannot follow as rapidly as the demand is caused by the increased opening; in other words, the governor will overrun. Now, after the readjustment of speed has finally been accomplished, either properly or improperly, we have got a different amount of water being delivered to the wheel as a result of the change of load, and you must return the by-pass, if there be one, or the water gate if there be one, to just the right position for this new condition. If you haven't any such returning device it is inevitable that you will have the seesawing or seeking, or hunting, or fluctuation, above and below normal, of the speed, because the returning device prevents the governor from overrunning or exceeding the movement which is necessary to restore normal speed.

XQ. 731. (By MR. WESTALL:) You have stated that the mechanism of defendant's exhibit Lamb patent has no returning device. Do you mean

that there are no means in the device of the Lamb patent referred to for preventing overrunning, or hunting?

A. If the Lamb patent were in reality what the inventor thought he was disclosing, the total amount of water would never vary. Part of the water is used to increase the speed, and the other part of the water to diminish the speed. In that sense it might be said, I think, that the Lamb patent, if it would operate as the inventor seems to think it would, would regulate for constant speed at any load. But, as has been shown, the water gate without in any way effecting the gate which he calls the brake water gate. So that in my opinion it would never operate; in fact, it is absolutely ^{ineffective} ~~imperative~~ as disclosed in the patent, for the regulation of constant speed.

XQ. 732. Did I understand you correctly as testifying that you find no mechanism disclosed in Defendant's exhibit Swiss patent for preventing the governor from overrunning or hunting?

A. No, sir, there is no such device in it.

XQ. 733. And is it your understanding of the construction therein disclosed, that the governor would overrun?

A. Yes, sir.

XQ. 734. And is your testimony the same with reference to defendant's exhibit French patent in suit?

A. Yes, sir.

XQ. 735. Referring now to defendant's exhibit

Berry blueprint No. 1, I will ask you how much time you had, previous to your testifying in this case concerning the construction illustrated in said blueprint, to study and familiarize yourself with the devices and disclosures of said blueprint?

MR. BLAKESLEE: Objected to as immaterial, the witness having testified that he understood the disclosure of this blueprint.

A. I had about two hours to go over this blueprint, but I was absolutely familiar with the misconception which the engineers had of this device at the time it was put in, and was familiar with its failure, and have often discussed it with various engineers, including Mr. Cobb, himself.

XQ. 736. (By MR. WESTALL:) Are you speaking now of the failure of the wheels to develop the required horse power, or of the governor mechanism?

A. Both.

XQ. 737. Did you put in two hours studying the blueprint referred to before testifying in this case?

MR. BLAKESLEE: The same objection as last noted.

A. Approximately two hours, yes, sir.

XQ. 738. (By MR. WESTALL:) I notice that you hesitated a considerable time before attempting to describe certain parts of the mechanism of said Defendant's Exhibit Berry blueprint No. 1, particularly the manner and place of connection of the water wheel shaft and the generator shaft, and that counsel for the complainant and Mr. Henry at that

time made certain informal suggestions not noted of record, which apparently enabled you to describe the construction. I will ask you if you are quite sure you understand the nature, operation and effect of the various devices illustrated in said blueprint?

MR. BLAKESLEE: Objected to as improper conduct on the part of counsel, and merely argumentative and not cross-examination; merely an attempt to slur the testimony of the witness and manifestly improper inasmuch as it attempts to inject something into the record which was not injected, if it might have been in fact, at the point in the record concerned.

A. I am very sure that I understand the method of connection and operation of the so-called Girard governor which is really a power transmission dynamometer as shown on Berry Blueprint No. 1. The only reason I hesitated was because I recalled at the time that it was installed incorrectly by the engineers when they first put it on. It was later on pointed out to them by other engineers, and I did not know whether this was a correct drawing, or an incorrect one.

XQ. 739. (By MR. WESTALL:) You are sure, then, that you would have understood the construction without any suggestion from Complainant Henry, or counsel for complainant, if you had been given a few moments to study the matter?

MR. BLAKESLEE: The same objection. We protest that this method of talking in the air about

something that is not of record, and which is without proper foundation at all.

A. I am quite sure I should, because the device is a simple power transmission dynamometer, and I have used them for purposes of measuring the amount of power transmitted an innumerable number of times in the past fifteen years.

XQ. 740. (By MR. WESTALL:) In describing certain parts of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 you stated that the plug-cock or body within the casing—this body, apparently, being numbered 46——

THE WITNESS: It is 41.

MR. BLAKESLEE: We wish to have the record show that counsel himself does not apparently understand the construction of the blueprint shown him.

MR. WESTALL: Counsel admits that he did not, owing to the folding of the paper. He supposed that the "1" of the figure referred to was a "6".

MR. BLAKESLEE: Objected to as argumentative.

(The reporter read the last question.)

XQ. 741. (By MR. WESTALL:) Was supported on one end by a bearing 41. I will ask you if you were referring to the actual structure that said Berry Blueprint No. 1 is said to illustrate or merely the device illustrated in said blueprint.

MR. BLAKESLEE: Objected to as embodying an inaccurate quotation.

A. I was referring to the Berry blueprint No. 1.

XQ. 742. (By MR. WESTALL:) How do you know what the stop-cock body (or, perhaps, we can say plug) within the casing is supported on one end by a bearing 41?

A. Well, what would lead any one to say that such was the case was the disclosures of figure 2 of Berry Blueprint No. 1 especially.

XQ. 743. Do the drawings of said figure 2 show a bearing at the point referred to?

MR. BLAKESLEE: Objected to as not calling for the best evidence; the blueprint speaking for itself so far as it goes.

A. The drawing shows the method whereby the cylindrical plug-cock of the valve is rotated by the socalled governing mechanism, and the outline of the plug-cock in dotted lines in the inlet pipe 46, which is fitted with a by-pass pipe 44-45

XQ. 744. (By MR. WESTALL:) And those details are sufficiently clear for you to be quite sure of your conclusion?

A. The details are clear enough to indicate very clearly that this cylindrical plug-cock is supported—whether you choose to call it a bearing, or a journal, or a shaft, or what not—on one end only.

XQ. 745. During your direct examination you did not state whether said Defendant's Exhibit Berry Blueprint No. 1 disclosed the body of the plug or stop-cock illustrated at 41 and 42, and referred to in the immediately preceding questions, "supported at its "end opposite said bearing 41". Do I understand you as meaning to imply that you do not find such

support for the end of said body of the plug or stop-cock cylinder at the end opposite bearing 41?

MR. BLAKESLEE: Objected to in so far as it misquotes the testimony, and as being merely argumentative and not cross-examination.

A. I do not find any support for the plug-cock 41 except upon one end as disclosed by the blueprint.

MR. WESTALL: XQ.746. You have testified that you found no indication on the part marked "J" of this Exhibit XX, of the part marked "A" in red pencil on Defendant's Exhibit Berry Blueprint No. 1. Please state what kind of an element or device you looked for on the part marked "J" in making such a comparison?

A. I looked for a bearing or support on the opposite end of the plug-cock type valve.

XQ. 747. Why did you look for such a bearing?

A. Because I desired to find out whether any was shown on Defendant's Exhibit XX" in the part marked "J".

XQ. 748. You assumed then, did you not, that the part marked "A" in red on Defendant's Exhibit Berry blueprint No. 1 was intended to indicate a bearing at the other end of said plug-cock cylinder?

MR. BLAKESLEE: Objected to as argumentative.

A. No, I did not have any idea that the red letter "A" on Berry blueprint No. 1 definitely or positively one way or the other represented that there was a bearing.

XQ. 749. (By MR. WESTALL:) Did you as-

sume that that might be the purpose of the dotted lines illustrating the construction shown at "A" in red on said defendant's exhibit Berry Blueprint No. 1?

A. Yes, sir, I so considered that it might be.

XQ. 750. As a matter of fact the dotted lines shown at said capital "A" in red on the last-mentioned exhibit could hardly be intended to represent anything else than that there was a bearing at the other end of the plug-cock cylinder, could it?

MR. BLAKESLEE: Objected to as merely argumentative and calling for a conclusion on the part of the witness, which is not the best evidence; the blueprint speaking for itself; and not proper cross-examination.

A. I would not conclude that the dotted lines necessarily indicate a bearing; they might indicate a cap over the end without any bearing at all.

XQ. 751. (By MR. WESTALL:) You have pointed out very positively a bearing 41 supporting the plug or stop-cock cylinder of the by-pass valve of defendant's exhibit Berry Blueprint No. 1. Do you mean to say that a trunnion or shaft supporting the other end of said body or plug of the stop-cock cylinder of said exhibit does not appear with equal clearness in said blueprint at the point indicated by the letter "A" in red thereon?

MR. BLAKESLEE: Objected to as placing an arbitrary interpretation on the testimony of the witness and as merely argumentative, and not cross-examination.

A. No, sir, it does not.

XQ. 752. (By MR. WESTALL:) Is it not very reasonable to suppose that the dotted lines shown at the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 were intended to indicate that the end of the plug-cock body was supported on a shaft or trunnion at the point indicated?

MR. BLAKESLEE: Objected to as merely argumentative and this is not the time to prove defendant's case, and if defendant has omitted to make out his case in connection with his own witnesses as to this blueprint produced by him and purporting to be made by one of his experts, he cannot now attempt to obtain evidence as to such showing.

A. I don't think so.

XQ. 753. (By MR. WESTALL:) Would not the support of the stop or plug-cock valve body at both ends be a very obvious remedy for any friction between the body of the plug-cock and its casing, supporting, as it would, the body of the plug-cock out of contact with its casing?

MR. BLAKESLEE: Objected to as merely argumentative.

A. It would not be a remedy for friction at all; it would merely tend to keep the plug-cock in line with its casing; but as obviating friction, any one experienced in plug-cocks knows that it would not do so; that the friction would result from small particles of sand, grit and foreign matter getting into the rotating valve, and the pressure in this case would be so great as to probably deflect and bend any

shaft that you could put in there, sufficient to make the valve inoperative on account of friction. In my experience I have never seen or known of a valve of this type being operative, whether it had a shaft extending clear through it and supported on both ends, or simply supported on one end, where the size of the valve is as large in proportion to the remainder of the mechanism as is shown on Berry Blueprint No. 1.

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XQ. 754. (By MR. WESTALL:) The principal difficulty, then, you believe in preventing the successful operation of such a valve would be the sand, silt, that would accumulate between the plug-cock body and its casing?

A. That would be one of the principal difficulties. There are other principal difficulties, such as the very large contact area between the movable or cylindrical part of the valve and its casing, which must fit tight enough to prevent excessive leakage, and also due to the fact that this type of valve, which, when it opens, does not leave its seat, but there is a constant friction which must be overcome, between the movable exterior surface of the cylindrical plug-cock and the surface of the valve seat or case, which friction continues at all times, whether the valve is closed or open, or fractionally open.

XQ. 755. Suppose that water used with such a plug-cock valve as you have been referring to was clear and free from silt and sand, would you still say that such a valve would necessarily be unsuccessful

in its operation, provided, of course, that the body portion of such valve was supported at each of its ends by trunnions or by a shaft extending through it and upon which it rotated?

A. I should say that the fact that the water was absolutely clear and free from any grit or foreign substance would reduce the friction effect, particularly as to this friction varying at different times; but it must be remembered in this valve that its diameter is about one-fifth of the diameter of the wheel itself, and it is so large, and the pressure of the water upon it so great that it is absolutely impossible to eliminate excessive friction and still keep the valve tight, even if the cylindrical plug-cock were mounted upon a shaft, and this shaft supported in suitable bearings on both ends.

XQ. 756. Assuming that the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 is intended to indicate that the body of the plug or stop-cock valve is supported by a trunnion at that end, and that the other end is supported by the shaft 41, as pointed out by you, it is a fact, is it not, that the body of the stop or plug-cock valve, if made sufficiently loose, could rotate freely in its casing, without any friction whatever?

MR. BLAKESLEE: Objected to as merely hypothetical and immaterial, particularly in view of the fact that the blueprint in question shows the plug-cock in intimate contact with its seat, being the best evidence.

A. I should answer the question by saying that

if that shaft only were placed in that pipe, and there was no cylinder whatsoever, that the friction caused by the pressure of the water on that cylinder would be so great as to cause considerable friction.

MR. WESTALL: XQ. 757. That is to say, providing nothing but a shaft extended through it?

A. Yes, because of the very large size of the valve.

XQ. 758. Would the operation be any different if you would connect to that shaft the two wings of a butterfly valve—in other words do you mean to say that the connecting to that shaft extending through there of two opposite wings of a butterfly valve would reduce the friction in any respect?

A. No, it would not reduce the friction; but the wings of a butterfly valve would tend to balance the effect on its two sides, and there would be merely the friction of the shaft upon its small bearings, and this would be effectively overcome by the balancing effect of the flow of water through the partly opened butterfly valve. It must be remembered in connection with all of this testimony that the serious effect of friction is due to sticking of the valve when it is at rest, and the overcoming of this friction from the time the valve is at rest to putting it in motion, thereby delaying and most seriously affecting the efficiency with which the speed is restored to its normal amount.

XQ. 759. So if I understand you correctly, if the shaft alone extended through such a plug-cock valve, leaving the body portion out entirely, the friction

at the bearings at the end would be excessive and would interfere with the rotation of such a shaft, but that if a butterfly valve were mounted on such shaft, the friction at the ends of the trunnions or shafts would be reduced by the butterfly valve?

MR. BLAKESLEE: Objected to as argumentative and not cross-examination, being purely hypothetical, and not calculated in any way to prove any issue in this case, and being contrary to the disclosures of the blueprint in question.

A. No, sir, I have not testified, nor have I said anything whatsoever that could be construed to indicate that there is excessive friction resulting from the shaft itself operating in its bearings.

XQ. 760. (By MR. WESTALL:) There would not be any more friction if such a shaft were located in the position just referred to without a butterfly valve being attached to it, than there would be with such a butterfly valve attached to such shaft, would there?

A. No, sir, it would make no difference whatsoever in the friction which would be produced between the shaft and the bearings of the shaft, whether it had a butterfly valve put on it, or not.

XQ. 761. As a matter of fact there would be more friction with a butterfly valve or anything protruding from the sides of that shaft than there would be without such protuberance?

A. No, sir, it would be no greater friction as far as moving the valves from one position to the other, whether it had a vein or a butterfly on it, or not, be-

cause there is absolutely no movement of the surface of the butterfly valve over a fixed surface; it simply rests down against the seat the same as a book lies upon the table. When the butterfly valve is opened it corresponds to lifting the book from the table.

XQ. 762. If the body of this plug-cock valve were supported at both its ends as disclosed in the immediately preceding questions, all that you said about the pressure of the water causing friction between the body of the valve and its casing (providing, of course the valve body was made sufficiently loose so as not to contact with its casing), would not be applicable to such a construction, would it?

MR. BLAKESLEE: Objected to as merely argumentative and hypothetical and not proper cross-examination.

A. The area exposed to pressure on the surface of the cylindrical plug of the valve, as shown in Berry Blueprint No. 1, is approximately eight times the area which is exposed for friction between the shaft and its bearings, and it is certainly very clear that inasmuch as the water pressure exerts a certain number of pounds pressure per unit of area, that the large area of the valve itself will cause a greater effect due to friction from this pressure than if we are considering only that of the shaft itself; the difficulty being with this valve, the very large area on the surface of the cylindrical plug subjected to the water pressure.

XQ. 763. (By MR. WESTALL:) And to what extent would you say that the water pressure upon

the large body of this valve, eliminating any question of friction with the casing, would interfere with the turning of the valve upon its shaft or trunnions?

A. The water pressure on the surface of the valve would, as I have stated in the last answer, increase the friction of the bearings, but the most serious friction, of course, results from the contact between the cylindrical rotating plug and its casing, this contact being sufficiently close to be water tight, or reasonably water tight under the pressure used at the plant.

XQ. 764. And do you believe that such water pressure, with the assumption made in the last question, that the plug does not come in contact with its casing, but is supported by a shaft or trunnion, is sufficient to prevent or seriously interfere with the turning or operation of the valve, assuming that the hearings are properly fitted and made?

MR. BLAKESLEE: The same objection as last noted.

A. I not only think so, but I know it from actual experience and an attempt to use such valve for the purpose indicated in Berry blueprint No. 1.

XQ. 765. (By MR. WESTALL:) That is to say you have had actual experience in using a valve, the body portion of which was supported at both its ends by a shaft or by trunnions, said body portion being made sufficiently loose so that it did not contact with its casing, and said valve body being as large comparatively as that illustrated in said Defendant's Exhibit Berry Blueprint No. 1?

A. Yes, sir, and I wish to make clear that my experience has been with a valve which actually was successful in stopping water when closed. Your question is unreasonable in that you state that the cylindrical plug does not in any way touch the casing, which is manifestly impossible, if it prevents water from flowing through the valve and leaking. There must be contact between the outer casing and the interior cylindrical plug, if it acts as a valve at all.

XQ. 766. It is true, is it not, that a butterfly valve, such, for instance, as is illustrated in Complainant's Exhibit A, might perform in a satisfactory manner its functions without coming in actual contact, when closed, with the pipe in which it was placed?

A. Yes, sir, as a matter of fact no butterfly valve that operates ever does come in contact on its outer edge with the pipe, but merely rests upon its seat, exactly as I have attempted to illustrate, as a book lies down upon a table; and the opening of the butterfly valve introduces no more friction than is introduced when you pick up a book from the table and lift it vertically upward.

XQ. 767. When you say that a butterfly valve rests upon its seat, what seat do you refer to?

A. The seat is a shoulder or projection on the inside of the pipe. The tightness of the valve does not depend at all upon the outside rim of the butterfly valve touching the interior of the pipe at all; its tightness depends absolutely and solely upon there

being reasonable continuity of surface between the seats of the butterfly valve and the seat of the valve.

XQ. 768. Do I understand you to say that this projection or seat extends entirely around the inside of the pipe so that when the butterfly valve is closed it rests against such a seat?

A. Practically so; not necessarily entirely, but practically so.

XQ. 769. Referring to Complainant's Exhibit Lyndon patent in suit, I will ask you to please point out in the drawings, or anywhere in the specification where any such seat is shown or described?

A. I think there is none so shown in the patent.

XQ. 770. So that so far as Complainant's Exhibit A is concerned, the valve therein shown would allow a considerable leakage of water by reason of its want of contact with the pipe, and by reason of the failure to provide or show any seat. Is that correct?

MR. BLAKESLEE: Objected to as being merely argumentative; the patent speaks for itself.

A. The valve is only shown in the diagrammatic drawing of figure 1. However, beginning with line 74 on page 4, the specification of the Lyndon patent states, "It is obvious that the by-pass, arranged as described, opening or closing in a manner opposite to "that in which the main gate opens or closes will, if properly" adjusted, admit of the main gate being rapidly operated and the "governing of the water wheel quickly accomplished." It is impossible to rapidly operate a plug-type valve when it is started

from rest. Again, quoting from line 80, page 4, "after the governing takes place the by-pass gate is either open or closed," or nearly so, and in order to be useful for a second "governing must return to its normal position." Now, no valve of this type can be closed, in the proper meaning of that word, without being provided with seats upon which to rest. In other words, it is not like a damper in a stovepipe, but actually is so constructed as to close, and prevents the passage of water when it is closed; but this condition of being closed and absolutely preventing the passage of water does not introduce any friction whatsoever at the instant that it is opened, because here is no rubbing of surfaces together.

XQ. 771. (By MR. WESTALL:) But do you not find anywhere in the patent any reference to a seat, or any illustration of a seat to be used with such butterfly valve?

MR. BLAKESLEE: Objected to as calling for the witness's conclusion and not the best evidence; the patent speaks for itself.

A. No, sir, I do not; but I definitely find the statement that the valve is closed, preventing the flow of water through the by-pass.

XQ. 772. (By MR. WESTALL:) It might be proper to say that a stovepipe damper was closed even though there was a slight space left around the periphery of such damper, might it not?

MR. BLAKESLEE: Objected to as merely argumentative and not a proper method of cross-examination.

A. To people who make stovepipes and that class of apparatus, yes, but to people who make valves that are to be tight under pressures of water up to a thousand pounds, I do not think that would be at all a sensible statement.

XQ. 773. (By MR. WESTALL:) It is a fact, is it not, that the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 is so designed as to allow a constant waste of water while operating under normal conditions of speed and load, is it not?

A. It may be, but the way in which the blueprint is shown, the valve is shut.

XQ. 774. Do you understand that such device is capable of an adjustment by which its normal position would be closed? I am speaking of Defendant's Exhibit Berry Blueprint No. 1.

MR. BLAKESLEE: Objected to as indefinite; no valve is specified.

A. I don't think it would be operative under any condition, whether the normal position of the by-pass valve were entirely closed, or partially open; but that would be quite immaterial, as to whether it was partly opened, or closed. It would be more difficult to operate the valve when it was entirely closed, however, than if it were partially opened, simply because if the valve were partly open the surfaces causing excessive friction would be somewhat reduced in area.

XQ. 775. (By MR. WESTALL:) When you say that you do not consider that it would be operative under any conditions, do you mean to say that you believe that the device would actually not work for any reason?

A. Yes, sir.

XQ. 776. Or not operate?

A. Yes; and to make that clear I will indicate a case. If the device shown on Berry Blueprint No. 1 was in operation at a given constant load upon the generator, and at normal speed, and for any reason the pressure in the pipe line should be reduced, such as a failure of the water to run into the pipe line from the forebay sufficiently rapidly, notwithstanding the fact that the speed and the load remained constant both, the mechanism in its operation would actually interfere with the constant speed, as a result of the reduction of the head disturbing the operation of the plant. That is the reason why I say that it would be absolutely inoperative in practice; because it is manifest that what is desired is constant speed, and even if the speed should remain constant because the load is constant, a reduction of the pressure of the water on the wheel, due to the action of the transmission dynamometer, which transmission of power from the water wheel to the generator, as shown in figure 1 of Berry Blueprint No. 1, would disturb and interfere with the normal operation, and tend to increase the disturbance caused by the reduction in head. That is the reason why I wish most definitely to be understood as saying that the device in its entirety, including the power transmission dynamometer, figure 1, the mechanism connecting this device with the plug-cock valve, all are inoperative in regulating for constant speed, even if the load does stay constant.

XQ. 777. When you say that the device of the plug-cock valve is inoperative, you do not mean thereby to

say that it is incapable of being moved in its seat, and of allowing the water to escape through it, and shutting off the water; assuming, of course, that such valve is supported by a shaft or trunnions, and is made to fit so loosely as not to come in contact with its casing?

A. I do not mean to say that the plug-cock valve is incapable of being moved, but I do wish to be understood as saying that its construction is such as to be incapable of being moved from rest with sufficient ease and quickness to accomplish any satisfactory result in the moving of a water-wheel and generator at constant speed. And I further wish to say that while the valve may be operative, it would be absolutely impossible—and this is confirmed by Mr. Cobb's tests—to regulate the speed without causing serious seesawing or hunting of the speed, first, we will say, above normal, and then below normal, rather than bringing the speed down, we will say, to normal without first going below normal, and then seesawing back and forward. Considering a thing inoperative is entirely a different thing from considering it operative for the purpose for which it is built. An automobile may be operative if enough men get behind it and push it, but if there is a serious defect in the engine it is not operative in the sense that it is supposed to be a self-propelling vehicle.

XQ. 778. If you were told by those who had actually seen the plug or stop-cock valve illustrated in Defendant's Exhibit Berry Blueprint No. 1, and had witnessed its operation, that after being filed down a little it worked perfectly, would you or would you not be driven to the conclusion that both ends of the body of

this stop-cock valve were supported in some way so as to obviate friction of said body with its casing, or that the friction between the valve and its casing did not have the effect you described on your direct examination?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. It is impossible for me or any one else to answer your question unless you explain more fully what you mean by the valve working perfectly.

MR. WESTALL: (XQ. 779). I mean by that that it performs the functions of its design perfectly?

MR. BLAKESLEE: The same objection.

A. Well, with my knowledge of the ^{power} proper transmission dynamometer and the attempt to use it as a speed regulating device—

XQ. 780. (By MR. WESTALL:) I am speaking more particularly of the valve.

MR. BLAKESLEE: I object to the interruption of the witness.

(The reporter read the answer of the witness.)

THE WITNESS: (Continuing:) It would make no difference what information was given me; I would be absolutely certain that it could not work perfectly in connection with the plug-cock valve in regulating the water wheel and generator at constant speed with variable load. If, however, you restrict your use of the word “perfectly” to the valve itself, independent of the rest of the so-called governing mechanism, I would assume that the cylindrical body of the plug-cock valve might have been filed down sufficiently so that it would work

perfectly backward and forward, opening and closing, whether or not it had a shaft extending entirely through its body with bearings on both ends, or not.

MR. BLAKESLEE: I move to strike out the answer on each of the grounds stated in the objection to the question.

XQ. 781. (By MR. WESTALL:) Have you any reason for any positive belief that the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 is not intended to indicate that the end of the body of the plug-cock valve opposite its bearing 41 is supported by a trunnion or extension to the shaft resting in the bearing 41?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination, and an attempt to prove on cross-examination of complainant's witnesses what defendant apparently could not prove in connection with this, its own exhibit, by means of its own witnesses, and when offering this exhibit in evidence; and as not calling for the best evidence.

A. Yes, I have reason to believe that it is not so intended, because it is not so drawn. If the shaft 42 were supposed to extend entirely through the plug-cock, it would be so shown by dotted lines throughout the entire length of the cylindrical stop-cock, and it is not so shown at all in the drawing.

XQ. 782. (By MR. WESTALL:) I don't believe you have fully answered the question, which also refers to the part "A" as being possibly intended to indicate a trunnion?

A. I may be able to answer that question if you will define what you mean by a trunnion.

MR. WESTALL: I will state that I am not an expert in mechanics, and therefore I leave the definition of technical terms to the experts, and inasmuch as the expert, the present witness, has used the term "trunnion" on several occasions, and has answered questions in which said word was used, I will ask the witness to please define the term "trunnion" as he understands it.

A. I have not used the word "trunnion" except in answer to questions where you used the word "trunnion", and when I have so answered it I have considered it as synonymous with the word "bearing", because no other interpretation of the word "trunnion", as you have used it, is possible in the context of your questions.

XQ. 783. Will you kindly, without any particular reference to the manner in which I may have used it, define the term "trunnion"?

MR. BLAKESLEE: Objected to as not cross-examination, and on the further ground that the witness has qualified as an expert.

MR. WESTALL: Counsel for defendant suggests that the last part of the objection, namely, that the witness has qualified as an expert, is the very reason why counsel for defendant assumes that he is able to answer the question.

MR. BLAKESLEE: I will say that the only thing that could make the question material or competent would be to test his qualifications as an expert; otherwise it is not cross-examination.

MR. WESTALL: We have already sufficiently tested the qualifications of the witness as an expert, and are not raising that question at the present time; but hav-

ing attempted to qualify as an expert, we assume that he is familiar with the terms which have been used and which are used in this connection, and if he is not familiar with those terms, counsel believes that it should be discovered at this time.

MR. BLAKESLEE: The question is not cross-examination. The witness has testified that there is no trunnion shown in the exhibit; therefore, the question is improper and merely repetitious in effect, if it is connected in any way with the examination.

MR. WESTALL: The question is repeated, and the witness is asked to answer it.

A. A trunnion is ordinarily defined as the equivalent of a shaft, the only point being as to whether common use of the word "trunnion" does not in some cases include, in addition to the shaft, the bearing in which the shaft rotates. The word "trunnion" is sometimes used to indicate merely an extension or circular portion of what is otherwise a casing, and it is not a definite mechanical term such as the word "shaft" or "shaft and bearing".

XQ. 784. Assuming that I have used the term "trunnion" in my previous questions in which the word has been used, as a protuberance upon the end of the cylindrical body portion of the valve illustrated in Defendant's Exhibit Berry Blueprint No. 1, which rests in some sort of a bearing, I will ask you to please state whether or not you have any positive reason for believing that the part marked "A" in red on said blue print does not indicate such a trunnion?

MR. BLAKESLEE: Objected to as merely argu-

mentative and not cross-examination, and a further attempt to prove something by complainant's witness which counsel apparently could not prove by his own witness when this exhibit was offered.

A. I can only repeat my answer to a former question, which is practically the equivalent of this question, namely, that the blueprint known as Berry Blueprint No. 1, and the detail as shown in figure 2, does not show any bearing, or support or trunnion supported by the main pipe 46, inasmuch as the so-called protuberance referred to by counsel only extends to the inner surface of the pipe as shown by dotted line.

XQ. 785. (By MR. WESTALL:) Do you understand that this valve is placed in the main pipe 46?

A. It is placed below the main pipe 46, numbered below "No. 44", and then still further below "45".

XQ. 786. You stated that this part marked "A" does not appear to show any trunnion or protuberance having any bearing in the pipe 46. Will you also state that it does not indicate any bearing in the pipe below the pipe 46, in which you have just stated that the valve is located?

MR. BLAKESLEE: The same objection.

A. No, the drawing does not show any detail which can be construed as a bearing supported upon a fixed part, either in the pipe 44, or the casing 43, which is the casing of the so-called by-pass valve, and the outlet of the by-pass valve to the by-pass discharge pipe 45. I repeat that the drawing does not show any such trunnion or bearing supported by a fixed part except upon one end, and that is shown on figure 2, and indicated by the number 42.

XQ. 787. (By MR. WESTALL:) What, then, do you understand is intended to be illustrated by the part marked "A" in red on said Defendant's Exhibit Berry Blueprint No. 1?

MR. BLAKESLEE: Objected to as not calling for the best evidence; the blueprint speaks for itself; and it is not assumed that counsel contends that this witness is a better witness in this matter than his own witness previously introduced, and who testified that he prepared this blueprint. Therefore, the question does not call for the best evidence in two respects.

A. As it is drawn, it appears to ~~me~~^{be} intended to represent only the farther plate-covering of the casing of the plug-cock valve 43.

XQ. 788. (By MR. WESTALL:) Do I understand you correctly as testifying that the transmission dynamometer used as a governor in the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 is sensitive to changes of load and speed?

A. Yes, sir.

XQ. 789. It is, then, a speed-sensitive device as well as a load-sensitive device?

A. It is a speed sensitive device and a load sensitive device, but not in any sense a governor for constant speed.

XQ. 790. You have never seen the actual mechanism of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1, have you?

A. Yes, sir.

XQ. 791. Where did you see that device?

A. I saw it down in a plant near Bakersfield.

XQ. 792. Did you observe its operation at that time?

A. No, sir, it had been taken out and discarded.

XQ. 793. When did you see it?

A. I saw it I should say about fifteen years ago.

XQ. 794. All of your testimony, then, as to how sensitive such devices might be, or how correctly the device referred to might provide for changes of load and speed, is based only upon theory and upon very brief study that you have been able to give defendant's exhibit Berry Blueprint No. 1 before testifying regarding it, as well as your examination of such device after it had been taken out, I believe you said fifteen years ago?

MR. BLAKESLEE: Objected to as calling for the witness's conclusion and placing an arbitrary interpretation upon the testimony of the witness, and not proper cross-examination.

A. My principal reason for testifying that it is absolutely inoperative as a device for maintaining constant speed at variable load is the construction of the device as shown by the drawing, as it is not a constant speed governor, but is a drawing of the well-known type of transmission power dynamometer, the use of which has been well known for at least twenty-five years. I also have what might be called hearsay knowledge of the failure of the device from the engineer, Cobb, and also the engineer, Mr. A. M. Hunt, who was called in to settle the difficulties and who immediately had the device taken off or so connected that it was merely the equivalent of a solid coupling between the water wheel shaft and the generator shaft.

MR. WESTALL: We object to any such hearsay evidence, and move that the answer, so far as it incorporates that character of evidence be stricken out.

MR. BLAKESLEE: It is to be noted as part of this answer that the knowledge of the witness comes from at least one witness on behalf of defendant in this case, and therefore it cannot be said to be hearsay any more than the testimony of a witness in the case might be hearsay.

MR. WESTALL: That witness has already fully testified as to the construction and operation of the device, and his testimony is of record.

XQ. 795. It is true, is it not, that the by-pass valve of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 might be adjusted to occupy a half opened position under normal conditions of speed and load, and might be constructed or arranged to occupy a more widely opened position under such conditions?

MR. BLAKESLEE: Objected to as calling for the conclusion of the witness and not the best evidence.

A. It could be constituted to operate in any such position whatever from fully open to fully closed.

XQ. 796. (By MR. WESTALL:) Still referring to the device Defendant's Exhibit Berry Blueprint No. 1, I will ask you how the by-pass valve of said device is designed or intended to operate when the speed of the water-wheel is increased, and how said by-pass valve acts, or is intended to act when the speed of the water wheel is decreased?

A. Will you please qualify whether you mean speed of the water wheel is increased or decreased by change of the load, or by the action of the governor?

XQ. 797. I mean whether the speed of the water-wheel is changed for any reason whatever; you can make your answer sufficiently broad to cover such differences?

A. If the speed of the water-wheel is increased, due to a decrease in the load, the design of the by-pass valve is supposed to be such as to increase the amount of water going through the by-pass valve by opening the same, thereby reducing the amount of water delivered to the wheel, with the result that the speed would be thereby reduced, corresponding with the reduction in the load. On the other hand, if the load upon the generator were increased, it would cause a reduction in the speed of the generator, and the by-pass valve is supposed to operate in such a way as to reduce the amount of water going through it, and thereby increase the amount of water delivered to the wheel, with the effect that the speed would be increased as the result of the larger amount of water going through it.

XQ. 798. What do you understand to be the purpose and object of the by-pass valve in the device Defendant's Exhibit Berry Blueprint No. 1?

A. In general to facilitate the proper adjustment of the amount of water delivered to the water wheel with changes of load; the total amount of water coming down the pipe line being divided into two parts, one part doing useful work by going through the water wheel, and the other part being wasted on by-passed as a result of the opening of the by-pass valve.

XQ. 799. Is it not true that when the governor of the device illustrated in Defendant's Exhibit Berry

Blueprint No. 1 acts to close the main gate or gates, that the device will open more widely the by-pass?

A. It is supposed to do that but it will not do it.

XQ. 800. That is the purpose and intent of the structure, is it not?

A. Yes, sir, that is the purpose.

XQ. 801. If the main gate or gates of the device, Defendant's Exhibit Berry Blueprint No. 1 opened, what do you understand to be the effect upon the by-pass valve, assuming that the device is operative, or would operate as intended?

A. That would altogether depend upon whether there was an increase of load upon the wheel. This might follow very properly: with a sudden load upon the wheel the by-pass valve would be supposed to close up so as to increase the amount of water on the wheel; but if that increase of load upon the generator should at the same time correspond with an increased water pressure for any reason, the by-pass valve would stay shut, and the increased pressure of the water would make up for the increased load. The power transmission dynamometer as shown in figure 1, would not be affected at any time, providing the amount of power transmitted through it would be the same, even if the speed should very greatly increase at the same time that the load upon the generator would be decreased.

XQ. 802. Still referring to Defendant's Exhibit Berry Blueprint No. 1 I will ask you if you find means for operating the water gate or gates in either direction, towards opened or closed?

MR. BLAKESLEE: Objected to as not calling for

the best evidence; the blueprint speaks for itself.

A. Yes, sir.

XQ. 803. (By MR. WESTALL:) And you also find such means for both opening and closing said water gates, do you not?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 804. (By MR. WESTALL:) Do you find a by-pass for the water wheel?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 805. (By MR. WESTALL:) Do you find a valve controlling said by-pass?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 806. (By MR. WESTALL:) Do you find means connected to the water gate operating means and operating the by-pass valve inversely to the operation of the water gate or gates?

A. Yes, sir.

XQ. 807. Do you find those various things referred to in your last preceding three answers in a water-wheel governor?

A. No, sir, I do not; I find it in connection with a power transmission dynamometer and not a water wheel governor.

XQ. 808. Referring to 'Complainant's Exhibit A, do you find such combination of elements in a water-wheel governor?

A. Yes, sir; and by "water-wheel governor" I mean one, the sole function of which is to maintain constant

speed of the water-wheel and the generator which it drives, under all conditions of varying load, varying water pressure, etc.

XQ. 809. Do you mean to say that in Complainant's Exhibit A the means for operating the water gates in either direction are parts of the water wheel governor?

A. Yes, sir, I should say it might be technically said that it is a part of the water wheel, rather than the water wheel governor.

XQ. 810. Might it also be technically said that the means for connecting the water gate operating means and operating the by-pass valve inversely to the operation of the water gate, is found in the transmission dynamometer of Defendant's Exhibit Berry Blueprint No. 1?

A. No, sir, the power transmission dynamometer figure 1, Berry Blueprint No. 1, has nothing whatever to do with the inverse action of the water gate and the by-pass valve.

XQ. 811. Such transmission dynamometer and its connecting parts were used, as a matter of fact, or intended to be used, in the device illustrated in said Berry Blueprint No. 1, to control the operation of the water gate valves and by-pass valves, under varying conditions of speed and load, were they not, and were therefore used to perform the functions of a governor?

MR. BLAKESLEE: Objected to as calling for the conclusion of the witness, and not a statement of facts in cross-examination, particularly in view of the objection of counsel for defendant that the present witness never saw nor witnessed the attempted operation of the alleged governor.

A. Yes, sir, that was the supposition.

XQ. 812. (By MR. WESTALL:) So that it is as logical to say that "means for operating the water gate in either direction and the "by-pass for the water wheel, "and the valve controlling said by-pass and means connected to the water gate operating means and operating "the by-pass valve inversely to the operating of the water gate are contained in a device used as a water-wheel "governor," when referring to Defendant's Exhibit Berry Blueprint No. 1, as it is to say that such combination of elements are found in a water-wheel governor when referring to "Complainant's Exhibit A"?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. No, the entire difficulty being that in Berry Blueprint No. 1 the so-called governor is not in any sense a governor for constant speed with varying load, while in the Lyndon patent, definitely and in every detail of the disclosure, it is set forth that the governor is a water-wheel governor for the purpose of maintaining constant speed, not only with varying load, but with varying water pressure. I want to be very clear upon this point: what do you call a water-wheel governor? What does it govern? Now, I am using the term "governor" with the understanding that it is a device for maintaining constant speed of the water-wheel with a variable load on the generator, and with a variable water pressure; and the device shown in figure 1 of Berry Blueprint is in no sense a governor of that kind; it is a governor which will be, through intervening mechanism, utilized for operating the water gates and a by-pass

valve, whenever any one of three things change, namely, speed, load or water pressure. In other words, the speed and the load may be absolutely constant, and still a reduction in the pressure on the pipe line will cause the by-pass valve to act and the water gate valves to act, and interfere with the satisfactory operation of the water wheel and generator at constant speed.

MR. WESTALL: XQ. 813. You do not mean to be understood, then, as saying that the words "water wheel governor", used in a broad sense, are not applicable to this power transmission dynamometer used as illustrated in defendant's exhibit Berry Blueprint No. 1?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. If you will specify what is governed by your governor, I will answer your question. I want you to distinctly specify whether you are governing speed, or whether you are governing the load, or whether you are governing the water pressure.

MR. WESTALL: I will not attempt to specify as requested, for the reason that I do not consider myself competent as an expert to do those things. I will have to have the witness make all the comparisons and point out the method of operation, which I do not pretend to be expert in. So, therefore, perhaps I cannot answer the question.

MR. BLAKESLEE: It is evident that the question is not such as the witness can answer with any definiteness that would make it of any value for the purposes of this examination. The question is therefore objected to as indefinite and incompetent and irrelevant.

MR. WESTALL: I think the question can be made clear by future questions.

XQ. 814. You have described this transmission dynamometer as illustrated in defendant's exhibit Berry Blueprint No. 1 as being sensitive to changes of speed and load, and by reason of this sensitiveness, communicating by various mechanical means, to the water gates and by-pass valve this sensitiveness, and thereby, by certain mechanism, causing these water gates and by-pass valve to open or close. I will ask you if you do not understand, in a broad general way, that such operation could be referred to properly as water-wheel governing, or as regulating the speed of a water-wheel?

MR. BLAKESLEE: Objected to as misleading and incorrectly quoting the witness, and, in fact, contradicting the witness in his testimony as to "sensitiveness", and also as to the production of any results due to any function of this dynamometer; and also as indefinite.

A. Yes, I should suppose it could be referred to in that way.

XQ. 815. (By MR. WESTALL:) And then in that sense, at least, this transmission dynamometer could be referred to as a water-wheel governor?

A. No, sir, it could not.

XQ. 816. Will you please reconcile your last answer with one preceding?

A. This transmission dynamometer would be, as it is always used in the way in which it is so represented in figure 1, as a device to keep the amount of power transmitted from the water-wheel to the generator absolutely constant. That amount of power might be at

257 revolutions, and it might be that that same amount of power might be as high as 300 revolutions, or as low as 200 revolutions. I wish to be understood this way: that as long as the amount of power transmitted from the water-wheel to the generator remains the same, no matter what happens to the speed, the whole mechanism will remain stable. Now, that is not what is desired in a water-wheel governor. What is disclosed in the Lyndon patent is a complete operating mechanism, partly electrical, partly mechanical, which will immediately tend to bring the speed back to normal, no matter what it is which changes that speed. That is the only thing the speed, itself; it regulates the speed and tends to keep it constant. Now, there are certain things that cause changes of speed in a water-wheel driving a generator. The most common one is a change of load upon the generator. Another thing that will change the speed of a water wheel, even if the load remains absolutely the same, will be a reduction or an increase in the pressure in the pipe line. What I wish to be understood as saying is this: that the Lyndon disclosure is specifically and completely that of a governor for the purpose of keeping the speed of the water wheel constant. I wish further to be understood as saying that the power transmission dynamometer as shown in figure 1 of the Berry Blueprint No. 1 is not, and cannot be used, and the device never has been used—in fact, it has always been used for an entirely different purpose namely, measuring the amount of power transmitted in this case between the water wheel and the generator. It cannot be used as a governor for constant speed, and when you attempt to use it as a governor for constant

speed, no possible result can come about except the unsatisfactory operation of the combination, and very serious stresses and strain upon every part of the mechanism, ultimately breaking it. I want to be perfectly clear upon that point, that the Lyndon patent is specifically one for the regulation of the speed of a water-wheel at constant speed, no matter what the load may be, or what the water pressure is, or what other things may change, the disclosure as set forth, particularly in figure 1 of Berry Blueprint 1, is a device for measuring the amount of power transmitted between a water-wheel which produces the power and the generator which absorbs the power; and I wish also to be understood that as long as the amount of power transmitted by that dynamometer remains the same—no matter what the speed is—nothing will happen to the rest of the mechanism. That was the defect, and the reason it failed.

XQ. 817. It is a fact, leaving out of consideration the question of the operativeness or success of the device, that this transmission dynamometer and its associated parts as illustrated in Defendant's Exhibit Berry Blueprint No. 1, was intended to be used to regulate the speed of the water wheel, is it not?

MR. BLAKESLEE: Objected to as calling for a conclusion on the part of the witness, and not the best evidence; defendant having had its opportunity by its numerous witnesses who testified about this exhibit, to tell the Court what the intention of this creation was.

A. I presume so, as there could have been no other reason whatsoever for introducing it except to regulate for constant speed when the load upon the generator varied, or the pressure in the pipe line varied.

XQ. 818. (By MR. WESTALL:) There was no object in inserting it there to measure the power, was there?

A. I don't know that, at all.

XQ. 819. So that if your conclusions are correct concerning the operativeness of the device, you could properly say that it was an attempted water-wheel governor, or a water wheel governor which was not successful?

MR. BLAKESLEE: Objected to as argumentative only, and calling for a conclusion, and not the best evidence, and not proper cross-examination.

A. I should say it was an attempted water wheel governor for maintaining constant speed, or an attempt to use a power transmission dynamometer as a water wheel governor for maintaining constant speed.

XQ. 820. (By MR. WESTALL:) And the only reason you hesitate to apply the term "water-wheel governor" to the device illustrated in said "Defendant's Exhibit Berry Blueprint No. 1" is because in your opinion the device referred to was not operative, or was not successful as a water-wheel governor; is that correct?

MR. BLAKESLEE: The same objection.

A. No, sir; my reason for saying that it is not a water-wheel governor is that that particular device as a power transmission dynamometer has been perfected to my personal knowledge more than twenty-five years, and if it were also a water wheel governor it would have been in use many years ago. As a matter of fact it is not a water-wheel governor, or a steam engine governor, or any other kind of a governor. It is a device for measuring the amount of power transmitted between a wa-

ter-wheel, for instance, and a generator, or between two shafts, one of which would be driven by a belt, and the other shaft absorbing the power, and its failure as a governor would have no effect upon my mind whatsoever, because I know from its construction that it is not a water-wheel governor or any other kind of a governor for constant speed.

XQ. 821. (By MR. WESTALL:) Now, you have stated in the device illustrated in Defendant's Exhibit Berry Blueprint 1, that you find no returning device. Do mean that there is no means intended, or no mechanisms contained or comprised within the device referred to, intended to prevent the governor from overrunning?

A. That is what I mean.

XQ. 822. So that your understanding is that in the construction last referred to in my last question, no provision or attempt of any kind by any of the mechanisms or arrangements therein, was made to prevent the overrunning you have described, or the effect of such overrunning?

A. No, sir, there is no provision made, and no provision to overcome the effects.

XQ. 823. So that you understand that if the device operated as it was intended to operate—for instance, referring to "Defendant's Exhibit Berry Blueprint No. 1"—that these overrunning effects would be present, and would prevent its successful operation?

A. There is no doubt about it; that is unquestionably the fact, even if the power transmission dynamometer had been replaced by proper governing mechanism to maintain constant speed.

XQ. 824. Referring specifically to the different

parts of the mechanism illustrated in the exhibit last referred to, will you please explain fully how the device would operate, assuming that it operated as was intended to permit this overrunning?

A. The device would operate in the following manner; if it were to operate as it was assumed to operate: a change of speed would cause a pull or a thrust in rod 17 connected to bell crank 19, which bell crank is connected by link 20 to straight bar 20, which would actuate a piston rod 23 leading to a valve 24. The movement of this valve would admit, in this particular case, water pressure to either one side or the other of piston 26 in cylinder 25, which, through connecting rod 27 and cross-head 29, would actuate, through a lever arm 31, the water gates, and through crank 49 the by-pass valve. Now, the by-pass valve and the water gate being both operated as a result of the motion of the connecting rod 40 and the crank 31, which moves the water gate, and the crank 49, which moves the by-pass valve, being both connected to this rod, will both be moving at the same time. Therefore, there is absolutely no provision whatsoever for the operation of what might be called a returning device, because when once set, the water gate valve must be moved if the by-pass valve is moved, and vice versa; and wherever this is the case, seesawing or hunting, or pumping, or fluctuation of speed above and below normal is absolutely unperventable.

XQ. 825. When you stated in referring to Complainant's Exhibit X, Lombard Governor Company Folder, that the use of a plug-cock valve with such a governor would be impracticable, or would not be successfully operated, you had reference, did you not, to a plug-cock

valve in which there was friction between the valve body and its casing, and not to a valve in which the body or plug is supported on a shaft or trunnion out of contact with its casing, had you not?

A. No, I have not distinguished as to whether the plug-cock was supported in one way or the other, but I did refer to a plug-cock valve in a pipe-line carrying water under heavy pressure, and, of course, not to small devices such as used in many minor mechanisms.

XQ. 826. To what extent if at all at the present time, are butterfly valves used with Lombard governors such as illustrated in Complainant's Exhibit KKK, or in Complainant's Exhibit X, Lombard Company Illustrated Folder?

A. They are used very extensively in low-head plants, but for high head plants the more satisfactory type of frictionless valve known as the needle valve is used.

XQ. 827. Can you mention any plant in which such butterfly valve is used in connection with a governor such as illustrated in Complainant's Exhibit KKK and in connection with a by-pass?

A. Great Western Power Company at Big Bend; the Drum plant of the Pacific Gas and Electric Company on the South Yuba River; the Electro plant of the Pacific Gas and Electric Company; Washington Power Company, Spokane River.

XQ. 828. In all the various water power plants that you have mentioned is this butterfly valve controlled by a Lombard governor such as illustrated in Complainant's Exhibit KKK?

A. Yes, sir.

XQ. 829. And is it used in a by-pass?

A. Yes, sir.

XQ. 830. And is that by-pass operated inversely to the main water wheel gate?

A. Yes, as a result of change of speed.

XQ. 831. You have spoken of the butterfly valve as being what is commonly called balanced, because, as I believe you stated, no matter what the difference in pressure on the two sides of the valve, there is no change in the amount of power to change its position. Referring now to Complainant's Exhibit Wilson Sketch A, I will ask you if it is not a fact that when the needle valve is closed it requires more power to open it than when it is partly opened?

A. Yes, sir, slightly.

XQ. 832. As a matter of fact, the entire pressure of the water back of the bulbous end of the needle shown in Complainant's Exhibit Wilson Sketch A, must be overcome before the needle can be moved backward?

A. No, sir, it must not. If the diameter of the rod leading to the bulbous and that you speak of is exactly equal to the diameter of the opening, the pressure would be equalized, of course, upon all sides of the needle nozzle itself; and the area exposed under any conditions to the difference in pressure is very small.

XQ. 833. In other words, if the diameter of the needle shaft—if that is the correct word—would prevent part of the pressure at the back of the bulbous end of the needle? Is that what you mean?

A. I would not say that it would prevent the pressure; but no matter what would be the pressure on the inside of a closed needle valve, the summation, or the to-

talling of all those pressures would be equalized, except that which is represented by the diameter of the nozzle.

XQ. 834. By "equalized" you mean to say that it would press equally on different parts of the rear portion of this bulbous nozzle?

A. No, I mean it would be equalized in all directions so that the net pressure would be zero. It is exactly as if we should take a baseball and throw it into a tank, the pressure on all the sides of that baseball would be such as not particularly to tend to crush it. It would be equal and opposite in all directions, as we say.

XQ. 835. Supposing, still using the baseball as an example, we take out the needle and substitute a baseball in the end, being held in position by the pressure of the water at its rear; before the baseball could be moved from its position as a stopper or plug of the end of the nozzle, all the pressure of the water behind it would have to be overcome, would it not?

A. No.

XQ. 836. Momentarily, at least?

A. No.

XQ. 837. Will you please explain why it would not?

A. The only pressure operating upon the needle would be due to the difference in area of the nozzle opening and the rod which carries the needle valve itself, which difference in area is very small, if not absolutely zero, as these needle nozzles are constructed.

XQ. 838. Answer the question. Will you please explain why it would not?

A. If we had a baseball at the end of the nozzle, the pressure upon the baseball would be due to the area of

the baseball represented by the area of the circle of the nozzle opening only.

XQ. 839. The pressure in the nozzle behind a spherical body located at the opening of the nozzle would operate upon such spherical body to hold it in position to a greater extent than if it had a shaft behind it, would it not?

A. Yes, sir, it would.

XQ. 840. That would be caused by the greater area upon which the pressure could act to hold the spherical body in its opening at the nozzle?

A. Yes, sir, the pressure per square inch, of course, would be exactly the same. The net area would be somewhat greater in the case of the baseball than if we should take a spherical body like a baseball and mount it upon a shaft, the diameter of this shaft being approximately equal to the diameter of the nozzle.

XQ. 841. So that it is a fact that when the needle nozzle is completely closed, to open such needle nozzle requires more power to move than it does when the needle of the nozzle is widely opened? Is not that true?

A. It is not true, because we balance that by means of a spring in the nozzle so as to make it absolutely balanced.

XQ. 842. But it is necessary to compensate for that extra power by use of this spring, is it not?

A. It is desirable to compensate for the extra pressure by the use of the spring.

XQ. 843. Is it true that the pressure on the opposite wings of a butterfly valve varies with its different positions assumed in moving full open to full closed positions?

A. The net pressure does not vary at all, no matter whether it is full open or full closed, because the pressure on one side is equalized by the pressure on the other side.

XQ. 844. Will you please explain why, no matter what the difference in pressure upon two sides of a butterfly valve is, there is no change in the amount of power to change the position of the valve?

A. Simply because, in changing the position of the valve you rotate one-half of the valve in the direction of the pressure, and you rotate the other half of the valve against the direction of the valve, and these two neutralize or equalize exactly.

XQ. 845. In the case of a needle nozzle illustrated in Complainant's Exhibit Wilson Sketch A, it is true, is it not, that the pressure of the water back of the bulbous end of the needle is exerted equally at all points back of said needle?

A. If the needle valve is absolutely closed, yes.

XQ. 846. Whether the valve is in open or closed position?

A. No, when the valve is open the needle part is drawn back within the water itself, so that there is a tendency to equalize the pressure in all directions then. In practise it may be said that in the operation of needle nozzles as constructed, there is no friction to be overcome as a result of the pressure within the pipe line, or in the vicinity of the nozzle.

XQ. 847. Isn't it a fact that in the needle nozzle illustrated in Complainant's Exhibit Wilson Sketch A, the water pressure exerted back of the bulbous head of the needle tends to press and hold the needle upon its

seat, and thus keep the valve closed, where, with a butterfly valve the full pressure of the water does not tend to keep the valve upon its seat, but that it can be moved as readily from full closed position as it can from half open to full open position?

A. Yes, I suppose it is true that there is a greater pressure upon the bulbous end of the needle nozzle when it is closed, unless it is neutralized, as we do, or compensated by a spring to equalize it, which is very readily and very satisfactorily done wherever it is required.

XQ. 848. You have likened the surrounding case of the by-pass valve of the device of this Berry Blueprint No. 1, to a brake-shoe, and the pressure of the water to the power pressing the shoe against the rotating part. In making this comparison you had in mind only, did you not, a plug-cock type of valve in which the body portion was not kept at all times out of contact with its casing by being adapted to rotate upon a shaft, or trunnions, had you not?

A. Yes, I had, but I wish to again state definitely that nobody ever saw a plug-cock type of valve which would hold water, that did not touch the casing; it must come in contact in order to be a valve in the proper sense of that word.

XQ. 849. Have you not stated previously upon your cross-examination that you had actually seen a plug-cock type of valve of approximately the same large comparative dimensions supported by a shaft or trunnion and so proportioned as not to come in contact with its casing?

MR. BLAKESLEE: Objected to as assuming a purely arbitrary construction which is not before us in this

case, and as not proper cross-examination, and indefinite, because no measure of the size of the plug-cock valve is defined.

A. I do not remember having so testified at all.

XQ. 850. (By Mr. Westall:) If you did make such statement do you wish now to say that you have never seen such a valve, that is to say a plug-cock type of valve, in which the body portion is so proportioned that it does not come in contact with its casing, but rotates upon, or is supported by a shaft or trunnion?

Mr. Blakeslee: Objected to as containing a negation in its very statement, inasmuch as the witness has testified that such a valve would not be a plug-cock valve.

A. I have never seen such a plug-cock type of valve, unless the plug-cock was taken out of the casing. I don't see how it would be possible to have the plug-cock in its casing without touching the casing, and yet be an operative valve.

XQ. 851. (By Mr. Westall:) Have you seen any form of valve so constructed?

A. I have seen a butterfly valve so constructed that it did not touch the interior of the pipe except the projections, as I have testified, corresponding to the seat of the valve.

XQ. 852. In comparing the needle type of valve with the butterfly valve you have testified that said valves have the following characteristics in common, namely, that the degree of opening of the valve may at any time change, whether from the position of being entirely closed to the position of being entirely open, without necessitating the overcoming of any friction between the moving parts of the valves and the surrounding case. It is true,

is it not, that a plug-cock valve in which the cylindrical body portion rotates, and is supported by a shaft or trunnions out of contact with its casing, also has the same common characteristics with the butterfly valve and the needle valve?

Mr. Blakeslee: The same objection, and further that it has already been answered, inasmuch as the witness has testified that such supposed plug-cock valve construction would not be a plug-cock valve.

A. If a plug-cock valve were constructed so that the outer surface of the cylindrical plug-cock did not come into contact with the casing of the valve, it would not be an operating valve at all, because it would not be tight; the amount of water going through the valve would not vary in proportion to the amount that the plug-cock was rotated.

XQ. 853. (By Mr. Westall:) Suppose that notwithstanding this supposed lack of practicability, it were so constructed, would it not have, in common with the needle valve and the butterfly valve, the characteristics described in the preceding question?

Mr. Blakeslee: The same objection, as merely argumentative.

A. I can only answer that by saying there is absolutely no possibility of any friction between two surfaces that do not touch one another.

XQ. 854. (By Mr. Westall:) And that therefore it would have the characteristics quoted in the question?

Mr. Blakeslee: The same objection.

A. It would have the characteristics, but it would not be a valve at all; it would simply be two parts that would not operate under any conditions as a valve.

XQ. 855. (By Mr. Westall:) You have stated upon your direct examination that the disclosures in the Lyndon patent set forth very clearly that the normal position of the by-pass valve may be anything which is desired by the operator to conform to operating conditions. Will you please refer to the patent and point out specifically where any such statement is made?

A. Quoting from the specifications in the patent, line 28, page 1, I find these words: "I provide a by-pass inserted into the penstock or flume at a point near the water gate and a gate in the said by-pass controlled by the the same governing mechanism that controls the water gate and operating to allow a greater or less flow through the by-pass, according as the water gate is being closed or opened."

Again, line 74, page 4: "It is obvious that the by-pass, arranged as described, opening or closing in a manner opposite to that in which the main gate opens or closes will, if properly adjusted, admit of the main gate being rapidly operated and the governing of the water wheel quickly accomplished. After the governing takes place the by-pass gate is either opened or closed, or nearly so, and in order to be useful for a second governing, must return to its normal position."

Again, beginning with line 99, page 4: "When the governing is completed, the controlling-solenoid allows the lever 26 to return to normal position, the circuit of the compensating magnet is broken by the return of rod 36 and lever 43, and the butterfly valve," which is the by-pass valve, "returns slowly under the influence of its weight 70 to normal position."

Again, line 35, page 4: "Normally the gate or valve

“in the by-pass will be half-way open, so that the amount
“of water flowing through the by-pass and around the
“wheel without doing work will be half the amount which
“the by-pass is capable of carrying.”

While that statement is made in the specifications, it is well known to those experienced in the art of governing water wheels, where the fluctuation of load is very slight, and the saving of water is important, that it is perfectly satisfactory to normally operate the by-pass valve even in a closed position, or nearly so. On the other hand, where the fluctuation of load, which causes the fluctuation of speed, is excessive and sudden and very frequent, the normal position of the by-pass valve would be partially open, so as to get the very best results of governing for constant speed and bringing the speed of the water wheel to normal as quickly as possible, with the least elapse of time.

XQ. 856. Suppose that the device of “Complainant’s Exhibit ‘A’” (Lyndon patent in suit) were so adjusted that normally the by-pass valve would be closed, and an increase of load were placed upon the water-wheel; please describe how the device of said Lyndon patent would operate?

A. It would not operate at all, inasmuch as the water wheel then would be taking absolutely all the water it possibly could get. If the load should be increased, the governing mechanism would be called upon to operate beyond its possible limitations.

XQ. 857. Still referring to the conditions described in the immediately preceding question, if an increase of load were thrown on the water wheel, it would have the

effect of decreasing the speed of the water wheel, would it not?

A. Yes, sir.

XQ. 858. And there would be no means, under the conditions outlined in the immediately preceding questions, for providing for that decrease of speed of the water-wheel?

A. There would be no means to increase the speed of the water wheel, because the governor is merely to control the amount of water delivered to the wheel, and if all the water available is being delivered to the wheel, the governor ^{may} has acted up to its possible limitations. A governor cannot be expected to produce more water per wheel.

XQ. 859. Then the device of said Lyndon patent in suit would not ordinarily be adjusted so as to have the by-pass valve completely closed under normal conditions?

A. Not ordinarily, but I have in mind a specific and definite water wheel and generator in Alaska which is operating so that under no circumstances shall it deliver to exceed 300 kilowatts; and in that case the governor is so operated that when the load exceeds 300 kilowatts the speed of the generator is allowed to drop, and that is the specific object of the governor in that case. That is not ordinary, however; that is a specific use of this governor. Nevertheless, the normal position of that governor when the load approaches 300 kilowatts is that the by-pass valve is closed; that, of course, is for the purpose of absolutely limiting the output of that particular water wheel and generator to 300 kilowatts.

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